ABSTRACT

OF

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MEDICAL DIRECTORS OF AMERICA

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An Abstract of the Proceedings

OF THE

Association of Life Insurance Medical Directors of America

THIRTY-FIRST ANNUAL MEETING

The Thirty-first Annual Meeting of the Association of Life Insurance Medical Directors of America was held in the Board Room of the Mutual Life Insurance Company of New York, No. 34 Nassau Street, New York City, on October 21 and 22, 1920, President Faneuil S. Weisse in the chair.

The following members were present at some time during the sessions:

C. D. Alton, H. B. Anderson, T. D. Archibald, A. W. Balch, W. B. Bartlett, J. T. J. Battle, W. W. Beckett, A. W. Billing, D. N. Blakely, W. M. Bradshaw, C. T. Brown, L. D. Chapin, C. L. Christiernin, E. A. Colton, H. W. Cook, J. N. Coolidge, R. M. Daley, E. W. Dwight, O. M. Eakins, Z. T. Emery, C. H. English, W. G. Exton, J. W. Fisher, Paul Fitz-Gerald, S. W. Gadd, Homer Gage, W. S. Gardner,

Arthur Geiringer, A. H. Gordon, Angus Graham, A. H. Griswold, F. L. Grosvenor, I. Haines, G. C. Hall, J. B. Hall, W. J. Hammer, A. B. Hobbs, Ross Huston, W. G. Hutchinson, C. B. Irwin, B.Y. Jaudon, W. A. Jaquith, A. E. Johann, A. O. Jimenis, M. L. King, A. S. Knight, W. W. Knight, E. H. Lines, J. M. Livingston, R. L. Lounsberry, L. F. MacKenzie, C. N. McCloud, T. F. McMahon, H. A. Martelle, C. F. Martin, O. F. Maxon, Paul Mazzuri, J. C. Medd, Herbert Old, M. I. Olsen, T. C. Park, J. A. Patton, W. O. Pauli, J. S. Phelps, J. E. Pollard, A. T. Post, J. T. Priestley, F. P. Righter, T. H. Rockwell, O. H. Rogers, E. K. Root, R. L. Rowley, E. F. Russell, S. B. Scholz, H. H. Schroeder, Morton Snow, J. B. Steele, G. S. Strathy, Brandreth Symonds, Harry Toulmin, J. P. Turner, G. A. Van Wagenen, W. R. Ward, J. H. Webb, W. E. H. Wehner, F. S. Weisse, F. C. Wells, F. L. Wells, C. D. Wheeler, C. F. S. Whitney, T. H. Willard, Gordon Wilson, M. C. Wilson, Glenn Wood.

The total attendance at all sessions was ninety-four.

On motion, the reading of the minutes of the last Annual Meeting was waived.

The Secretary read the minutes of the meetings of the Executive Council, held on May 25, 1920, and October 20, 1920. On motion the minutes were approved as read.

It was moved by Dr. Willard and seconded by Dr. Fisher that, without establishing a precedent, the rule be waived in the case of the Bankers Life Company of Des Moines, requiring that a Company shall have conducted its business on the Legal Reserve

Plan for at least ten years, and that the Bankers Life Company be admitted to the privileges of the M. I. B.

Motion carried.

The names of the following candidates for membership recommended by the Executive Council were presented:

Dr. Joseph T. Cabaniss, Assistant Medical Director of the Travelers Insurance Company, of Hartford, Conn.

Dr. John P. Chapman, Assistant Medical Examiner of the Penn Mutual Life Insurance Company, of Philadelphia, Pa.

Dr. Samuel W. Gadd, Medical Director of the Philadelphia Life Insurance Company, of Philadelphia, Pa.

Dr. William S. Gardner, Medical Inspector of the Mutual Life Insurance Company, of New York, N. Y.

Dr. William J. Hammer, Acting Medical Supervisor of the New York Life Insurance Company, of New York City, N. Y.

Dr. Ross Huston, Medical Director of the Bankers Life Company, of Des Moines, Iowa.

Dr. Benjamin Y. Jaudon, Medical Director of the Missouri State Life Insurance Company, of St. Louis, Mo.

Dr. Albert E. Johann, Assistant Medical Director of the Travelers Insurance Company, of Hartford, Conn.

Dr. John M. Livingston, Assistant Medical Director of the Mutual Life Assurance Company of Canada, Waterloo, Ontario, Canada.

Dr. Paul Mazzuri, Acting Medical Supervisor of

the New York Life Insurance Company, of New York City, N. Y.

Dr. Thomas C. Park, Assistant Medical Director of the Travelers Insurance Company, of Hartford, Conn.

Dr. William A. Peterson, Medical Director of the Mutual Trust Life Insurance Company, of Chicago, Ill.

Dr. Charles B. Piper, Medical Director of the Guardian Life Insurance Company, of New York City, N. Y.

Dr. John B. Steele, Medical Director of the Volunteer State Life Insurance Company, of Chattanooga, Tenn.

Dr. Charles A. VanDervoort, Assistant Medical Director of the Fidelity Mutual Life Insurance Company, of Philadelphia, Pa.

It was moved by Dr. Toulmin and seconded by Dr. Willard that the Secretary be instructed to cast a ballot for the election of these new members. Motion carried. The Secretary announced the ballot so cast, and the candidates were declared elected. The President appointed Dr. H. W. Cook and Dr. J. B. Hall a Committee to introduce the newly elected members to the Association. Five of these new members were present and were escorted into the room and introduced by the Committee.

Mr. C. A. Peabody, President of the Mutual Life Insurance Company of New York, welcomed the members of the Association in the following brief address:

Gentlemen:—I bid you welcome here and express the hope that you will enjoy anything that we have in the way of facili-

ties, and that you will ask for anything that you do not find here. We assure you that if it is within our power we will be happy to supply it. The place and all that we have in the way of facilities are at your service. We are very glad that you are meeting here to-day.

The President read the new By-Law covering the election of officers. In accordance with this By-Law the Nominating Committee appointed by the Executive Council presented the following nominations for officers and members of the Executive Council:

PRESIDENT

DR. AUGUSTUS S. KNIGHT

FIRST VICE-PRESIDENT

DR. THOMAS F. McMAHON

SECOND VICE-PRESIDENT

DR. F. L. GROSVENOR

SECRETARY

DR. ANGIER B. HOBBS

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EDITOR OF THE PROCEEDINGS

DR. R. M. DALEY

EXECUTIVE COUNCIL

DR. G. A. VAN WAGENEN
DR. E. W. DWIGHT
DR. J. ALLEN PATTON

President Weisse called for further nominations, and no further nominations being presented, Dr.

Toulmin moved that the nominations be declared closed and the Secretary instructed to cast a ballot at the election of officers on the morning following, for the officers and members of the Executive Council so nominated. Dr. Hall seconded the motion and it was carried.

The Treasurer read his report. After being duly audited by the Committee appointed by the President, namely, Dr. W. A. Jaquith and Dr. R. L. Rowley, the report was accepted.

The business submitted by the Executive Council was taken up. It was moved by Dr. Symonds and seconded by Dr. Willard that the recommendation of the Executive Council be adopted, and that the practice of reporting "dead" cards to the Library Bureau be discontinued. Motion carried.

It was moved by Dr. Toulmin, and seconded by Dr. Whitney, that the Association approve the action of the Executive Council in assessing each member Five Dollars for current expenses. Motion carried.

Dr. Rogers read the report of the Special Committee in charge of the M. I. B. On motion this report was adopted as read.

It was moved by Dr. Willard and seconded by Dr. Toulmin that the Special Committee in charge of the M. I. B. be and is hereby authorized to make from time to time such changes in the rate of compensation paid to the Library Bureau as the circumstances justify. Motion carried.

President Weisse delivered the following address:

Gentlemen, it gives me great pleasure to extend to you all a hearty welcome as guests of the Mutual Life Insurance Com-

pany, and I trust that you will find the meeting both pleasant and profitable.

The last year has been a pleasant one in the insurance world, comparing with our bitter experience in 1918 and 1919.

The great increase in new business with disorganization of office and examining forces, due to war conditions, has made the work more strenuous in all of our Home Offices. In spite, however, of the handicap of many new examiners and of the vast increase in new business, the mortality—as far as I can learn—has been generally satisfactory.

I hope that some record is being kept of the deaths from causes other than influenza, where the condition causing death was directly traceable to epidemic influenza. I think such data will probably be of value in a future epidemic and I know of no way in which the medical profession can obtain such data except through the Medical Departments of the various insurance companies.

I have been recently reviewing the report of the Surgeon-General of the Army on "Defects Found in Drafted Men," which was compiled for the Congressional Committee and was based on the examinations of 2,753,922 individuals.

I find that while 468 men per 1000 were found to have some defect, only 147 per 1000 showed defects that would have an important bearing in an applicant for life insurance.

TABLE "A"

		Per M.
7	Tuberculosis	24.86
8	Syphilis	10.47
12	Alcoholism	.31
13	Drug Addiction	.54
16	Diabetes	.27
17–18	Goitre	7.49
19	Obesity	1.80
20	Apoplexy or Paralysis	2.55
21	Epilepsy	5.15
26	Nervousness	.89
38	Mental	15.08
46	Otitis Media	8.57
53	Organic Heart	30.74
55–56	Irregular and Rapid Heart	6.25
61–62	Bronchitis and Asthma	3.18
72	Arthritis	2.31
87	Underweight	26.50
		146.96

This percentage of rejection would be very high for any Company for ages up to 31, and especially so with urinary findings not considered. This condition certainly calls for all the help that the insurance companies can give by instruction in hygiene, by social service work, where possible, etc. This is to me, one of the strongest possible arguments for this Association getting out into the field and becoming more closely identified with the Public Health Association and other like Associations which are endeavoring to foster health education. Dr. Willard in his paper makes this same point.

The following table gives some interesting data with reference to the general distribution of the most important physical defects per thousand rejected:

TABLE "B"

Diseases	Chicago	Boston	New York	Phila.	Selected Urban (25,000 & over)	Rural
Total Cardiac	50.35 (−2.81)	51.42 (−1.74)	63.41 (+10.25	57.35 (+4.19)	53.16	38.95
Total Tuberculosis	32.03 (−1.29)	31.96 (−1.34)	30.91 (− 2.41)	31.71 (−1.61)	33.32	27.87
Total Nervous and Mental	15.24 (− .20)	18.49 (+3.05)	16.36 (+ .92)	14.81 (− .63)	15.44	23.61
Epilepsy	4.53 (− .26)	6.13 (+1.34)	5.62 (+ .83)	5.52 (+ .73)	4.79	5.36
Syphilis	6.16 (−1.32)	4.20 (−3.28)	3.37 (− 4.11)	3.98 (−3.50)	7.48	6.64
Simple Goitre	11.51 (+7.14)	.20 (−4.17)	.76 (− 3.61)	1.11 (−3.26)	4.37	4.33
Exophthalmic Goitre	8.59 (+4.83)	.56 (−3.20)	2.78 (− .98)	2.12 (−1.64)	3.76	2.80
Arthritis	2.15 (+ .16)	1.62 (− .37)	1.26 (− .73)	1.51 (− .48)	1.99	2.48
Alcoholism	1.36 (+ .80)	1.57 (+1.01)	.44 (− .12)	.46 (− .10)	.56	.17
Drug Addiction	.24 (− .80)	.86 (− .18)	2.15 (+ 1.11)	1.07 (+ .03)	1.04	.26

I have been fortunate enough, through the courtesy of Major General Merritte W. Ireland, Surgeon-General of the United States Army, to obtain copies of the advance sheets of the final results of battle injuries of the A. E. F., 1917–1918, caused by military agents and gassing. I am advised by the Surgeon-General's Office that the complete tables, of which these are a part, will appear in the Annual Report of the present year which will be available for distribution about December 1st. I have tabulated in a general way the results of these tables in Table "C." I have selected from the disabilities caused by military agents the following items, which I think will be of interest to the Association.

AMPUTATIONS

Upper Extremity			*Lower Extremity*		
Hand	—One	22	Foot	—One	144
	Both	1		Both	4
Forearm	—One	229	Leg	—One	487
	Both	3		Both	12
Arm	—One	602	Thigh	—One	1057
	Both	0		Both	11
TOTALS	—One	853	TOTALS	—One	1688
	Both	4		Both	27

One upper and one lower extremity—10.

There were no cases in which either three or four extremities were amputated.

Sight was destroyed, including loss of eye:

One	667
Both	44

PARALYSIS

Upper Extremity		*Lower Extremity*	
One	393	One	254
Both	2	Both	8

The 2556 disabilities as a result of gassing were divided as follows:

Respiratory	2298	3.3 %
Cardiac	108	.15
Eyes (Blind, 21)	86	.12
Nervous System	17	.02
All Others	47	.07

I am advised from the Surgeon-General's Office that they are unable, as yet, to give me the number of cases of tuberculosis associated in any way with gassing. From the information available, the number was relatively small but the actual statistics have not yet been prepared.

I have selected from the Reports of the Surgeon-General's Office for 1918, covering the year 1917, and from the first volume of the 1919 report, covering the year 1918, a few tables which I think will be of interest to the members of the Association.

Tables "D" and "E" show the total number of discharges for disability and deaths, with the ratio per 1000 for all conditions other than battle injuries. In 1917, No. 1 gave total deaths of 1505; of these, 23 were due to typhoid fever and 14 to influenza, from a mean strength of 671,156. In 1918, No. 1 gave total deaths of 26,567; of these, 133 were due to typhoid fever and 22,920 to epidemic influenza, with its complications, from a mean strength of 2,500,832. From this it would appear that almost 46% of the total deaths outside of battle injuries and killed in action were caused by epidemic influenza.

Table "F" shows admissions, deaths, and discharges during 1917 and 1918 for diseases of special interest from the insurance standpoint, and also the physical status of demobilization examinations up to July 1, 1919. This last report gives us a very excellent idea of the amount of disability, as it shows that a fraction less than 6% of the total number examined—over two and a half million—were reported to the Bureau of War Risks with disability.

Table "G" refers entirely to cardiac conditions and I will be very much interested in seeing how, after one or two years'

experience, our reports to the M. I. B. of definite cardiac conditions will appear in relationship with each other, as compared with this table.

I think the members will be interested to know what the figures on admissions, deaths, and discharges were with reference to shell-shock. During the year 1918, the total admissions were 3795, deaths 3, and discharges with disability 13.

I sincerely hope that our meeting this year, with our papers on Selection of Risks and the Influence of Occupation on Mortality, may bring us nearer the time referred to by Doctor Rockwell in his address last year, "when an individual who applies to several companies at the same time will receive practically the same treatment from each." The Medical Department of each Company will, of course, always have its own ideas about certain conditions and I think it is far from the wish or thought of any members of the Association that we should all wear the same straitjacket as far as our individual ideas on selection are concerned; but I do hope, and I think we all hope, that we will arrive some day at a practical mutual basis, on which we will accept or decline cases so that we may do away with the condition which is a bugbear to us all—not only to the Medical Department but to the Insurance Department and the Actuaries as well—*i.e.*, the condition under which an applicant will be rejected by one Company and—giving practically the same history—be accepted on standard rates by, so to speak, its next-door neighbor.

During the past ten years I have watched with a great deal of pleasure the coming together of the Actuarial and Medical Departments among the associated companies, and I am happy to say that during our meeting we will hear from several of our actuarial friends. One of the papers presented is by our good friend Mr. Arthur Hunter, who has probably done more than any one man to help turn the thoughts of the insurance medical profession into near actuarial channels. I feel sure that the closer association of the Medical and Actuarial Departments will do much toward bringing about a uniformity of action on risks by the associated companies.

TABLE "C"

BATTLE INJURIES A. E. F.—1917–1918

Final Results of Military Agents (other than gases) 12/31/19

		Absolute Numbers	Disabilities 10% or More Discharged No.	%	Died	
Gunshot Missiles	Rifle	20,420	3,739	18.3		
	Shell	17,439	3,843	22.0		
	Shrapnel	33,787	5,217	15.4		
	Hand Grenades	880	213	24.2		
	Gunshot not Specified	75,125	5,579	7.4		
	Total	147,651	18,591	12.6	12,192	8.3%
	Other Military Agents	5,886	549	9.3	278	4.7%
	Total Military Agents (other than gases)	153,537	19,140	12.5	12,470	8.1%

Final Results of Gassing—12/31/19

Gases	Poison Gas (kind not specified)	33,587	2,111	6.3		
	Chlorine	1,843	56	3.0		
	Mustard Gas	27,711	319	1.2		
	Phosgene	6,834	70	1.0		
	Arsine	577	.....			
	Total Gases	70,552	2,556	3.6	1,221	1.7%

Total Number Disabled	224,089	100.0%
Discharged disability 10% or more	19,768	8.8%
" degree disab. not stated	820	.4%
Remaining in Hospital degree disability not stated—Dec. 31, 1919	5,768	2.6%
Died	13,691	6.1%
Discharged without disability	184,042	82.1%
Killed in action	34,249	

TABLE "D"

TOTAL—OFFICERS AND MEN (AMERICAN TROOPS)
COMBINED FROM TABLES NO. 16 AND NO. 17—NO. 18 AND NO. 19
1918 REPORT (YEAR 1917)

Mean Strength—671,156

	DISCHARGED FOR DISABILITY		DEATHS	
Cause	Absolute Number	Ratio per M.	Absolute Number	Ratio per M.
1—Infectious disease (excluding Tuberculosis and Venereal)	178	.27	1,505	2.24
2—Tuberculosis (all)	38,08	5.67	139	.21
3—Venereal diseases (all)	785	1.17	30	.04
4—General diseases	1,035	1.54	70	.10
5—Nervous System diseases—(all)	1,195	1.78	60	.09
6—Mental Alienation	2,151	3.20	27	.04
7—Eyes and their Adnexa, diseases of	706	1.05	4	.01
8—Ear, diseases of	607	.90	21	.03
9—Nasal Fossæ, diseases of	59	.09	4	.01
10—Throat, diseases of	23	.03	24	.04
11—Circulatory System, diseases of	1,853	2.76	89	.13
12—Respiratory System, diseases of	375	.56	1,086	1.62
13—Digestive System, diseases of	935	1.39	161	.24
14—Genito-Urinary System and Adnexa Non-venereal diseases	373	.56	59	.09
15—Skin and Cellular Tissue, diseases of	153	.23	26	.04
16—Bones and the organs of Locomotion, diseases of	2,215	3.30	1	.00
17—Congenital Malformations and Ill-defined diseases	95	.14	15	.02
18—Traumatisms produced by external causes	1,151	1.71	822	1.22
Grand Total	17,697	26.37	4,143	6.17

TABLE "E"

TOTAL—OFFICERS AND MEN (AMERICAN TROOPS)
COMBINED FROM TABLES NO. 27 AND NO. 28—NO. 23 AND NO. 24
1919 REPORT (YEAR 1918) VOL. I

Mean Strength—2,500,832

	DISCHARGED FOR DISABILITY		DEATHS	
Cause	Absolute Number	Ratio per M.	Absolute Number	Ratio per M.
1—Infectious disease (excluding Tuberculosis and Venereal)	922	.37	26,567	10.62
2—Tuberculosis (all)	10,082	4.03	965	.39
3—Venereal diseases (all)	8,839	3.53	109	.04
4—General diseases (other)	11,671	4.67	264	.11
5—Nervous System diseases(all)	11,247	4.50	303	.12
6—Mental Alienation	17,940	7.17	60	.02
7—Eyes and their Adnexa, diseases of	4,183	1.67	16	.01
8—Ear, diseases of	4,002	1.60	188	.08
9—Nasal Fossæ, diseases of	335	.13	195	.08
10—Throat, diseases of	108	.04	175	.07
11—Circulatory System, diseases of	15,191	6.07	357	.14
12—Respiratory System, diseases of	4,070	1.63	16,343	6.54
13—Digestive System, diseases of	5,643	2.26	915	.37
14—Genito-Urinary System, diseases of Non-venereal	1,603	.64	276	.11
15—Skin and Cellular Tissue, diseases of	1,124	.45	150	.06
16—Bones and Organs of Locomotion, diseases of	14,688	5.87	28	.01
17—Congenital Malformations and Ill-defined diseases	1,355	.54	265	.11
18—Traumatisms produced by external causes	1,852	.74	3,492	1.40
Total	114,854	45.93	50,668	20.26

TABLE "F"

TABLE SHOWING ADMISSIONS, DEATHS, AND DISCHARGES DURING 1917 AND 1918 FOR DISEASES OF SPECIAL INTEREST FROM THE INSURANCE STANDPOINT

		Measles	Influenza	Meningitis Cerebro-Spinal (Epidemic)	Mumps	Articular Rheumatism	Tuberculosis	Syphilis	Arthritis	Diabetes	Dis. of Thyroid (simp.) Goitre exc.)	Alcoholism	Epilepsy	Dementia Præcox	Mental Deficiency	Valvular Cardiac	Other Organic Dis. of Heart	Pneumonia	Nephritis	
1917	Admissions	50,470	40,326	1080	26,871	5,416	7,901	10,125	3,740	123	624	1835	1782	933	1,638	2,518	1245	9,498	851	Mean Strength 671,156
	Deaths	975	14	337	9	5	139	25	2	18	1	16	6	2	.....	10	41	1,060	52	
	Discharges	21	4	14	1	80	3,808	428	348	29	214	123	655	484	1,040	1,059	390	31	109	
1918	Admissions	46,730	681,218	2956	168,332	17,653	22,832	43,951	22,251	439	5560	2183	6148	4405	10,218	11,872	4477	57,662	2858	Mean Strength 2,500,832
	Deaths	1,478	22,920	1178	151	35	965	91	24	64	7	32	28	14	4	66	141	15,156	243	
	Discharges	87	158	141	37	270	9,454	2,423	4,832	166	4040	253	3978	3189	8,249	7,424	1819	370	500	

Physical Status of Demobilization Examinations from Nov. 11, 1918, to July 1, 1919

Total Officers and Men (American Troops)

Discharged with no disability	2,327,494
Reported to Bureau of War Risk:	
Insurance with disability	149,433
Held on account of Communicable Disease	19,339
Held for Maximum Degree of Improvement	2,777
Held for other causes	1,619
Total number examined	2,500,662
Per cent. Reported to B. of W. R. with disability	5.97%

TABLE "G"

SHOWING DETAILED CLASSIFICATION OF CARDIAC CONDITIONS

1918	Aortic Insufficiency	Aortic Stenosis	Mitral Insufficiency	Mitral Stenosis	Combined Lesions, Mitral, Aortic	Pulmonic Lesions	Tricuspid Lesions	Valvular Lesions Unclassified	Valvular Diseases of the Heart (Total)	Cardiac Hypertrophy	Cardiac Dilatation	Myocarditis & Myocardial Insufficiency	Heart, Other Organic Diseases of	Organic Diseases (Total)	Cardiac Murmurs not Organic	Cardiac Disorders, Functional	Cardiac Arrhythmias	Bradycardia	Tachycardia	Neuro-Circulatory asthenia	Total Functional	Mean Strength 2,500,832
Admissions..	1159	1175	7048	2299	245	7	28	911	11,872	832	420	2119	1106	16,349	152	4412	1028	74	4165	3023	12,854	
Deaths.....	58	...	35	6	5	..	1	11	66	7	7	45	26	207	...	...	....	..	...	4	211	
Discharges..	873	122	4085	1737	168	4	3	432	7,424	405	68	810	476	9,243	13	2829	572	4	756	1550	5,724	

Dr. J. W. Fisher then presented the following report of the Committee on Blood Pressure:

FURTHER REPORT OF THE DIAGNOSTIC VALUE OF THE SYSTOLIC AND DIASTOLIC BLOOD PRESSURE

By J. W. Fisher, M.D.

In Table I will be found a record of 1244 risks accepted by the Northwestern Mutual Life Insurance Company during the years indicated. This table includes only cases examined at the home office or by well-trained examiners in the field, located in the larger cities and towns, who understood the proper methods of determining the blood pressure by the auscultatory method. Very few cases have been rejected on account of high diastolic pressure where the palpatory systolic pressure was not more than 12 mm. above the average for the age. A longer period of exposure may show different results.

Table II shows results in keeping with the scanty material reported in 1915 (see pages No. 204 and No. 214, Transactions of this Association of the years 1915 and 1916). After eliminating the causes of death from casualty and influenza-pneumonia, there were only eight deaths from other causes. It has been estimated that, including deaths from all causes, the mortality was about 35% of the expected by both the A. M. and M. A. Tables. The fact should not be overlooked that the systolic pressure was by the palpatory method and included examinations by all our regularly appointed examiners where we were satisfied we had an accurate palpatory blood pressure reading.

Tables III and IV are based on risks accepted during the years indicated, being the same class as shown in our 1915 report (pages No. 204 and No. 214) of the Transactions of this Association for the years 1915 and 1916, with five additional years of exposure added. We have not completed our investigation of rejected risks on account of high blood pressure during the past five years. The same is under investigation. We are satisfied, from the number of deaths thus far reported,

that the mortality will be quite as unfavorable as shown in our report of 1915.

All of the data relating to blood pressure, reported in the Transactions of this Association by the Northwestern Life, relates to lives and not to policies or amounts, and the expected is computed to the time indicated in each table, where we have knowledge that the risk is living, though some of the policies from which data is obtained, may have, in the meantime, been surrendered, lapsed, etc.; and when the case was rejected, from the date of such rejection.

I cannot refrain from again bringing to the attention of this Association the fact often repeated, namely, that we are ignoring much valuable information, as practically every Company represented here is in position to furnish the mortality on risks accepted with a systolic blood pressure of 15 mm. or more in excess of the average, also with low systolic and high diastolic pressure, or at least to furnish the records of such cases to your committee, to be compiled, in view of the fact that the larger the volume, the more accurate will be the results.

TABLE I

THE NORTHWESTERN MUTUAL LIFE INSURANCE COMPANY ACTUAL MORTALITY TO AUGUST 1, 1920, AS COMPARED WITH EXPECTED (M.-A. TABLE). ACCEPTED RISKS WITH DIASTOLIC BLOOD PRESSURE OF 95 MM. AND ABOVE, ISSUES OF 1915–1920 TO JULY, INCLUSIVE

Ages at Entry								*All Ages at Entry*			
16–39				40–60							
Number	Expected	Actual	Per Cent.	Number	Expected	Actual	Per Cent.	Number	Expected	Actual	Per Cent.
482	6.473	4	62	762	21.514	18	84	1244	27.987	22	79
Average Diastolic Blood Pressure—99 mm.				Average Diastolic Blood Pressure—100 mm.				Average Diastolic Blood Pressure—99.5 mm.			

CAUSES OF DEATH

AGES 16–39	NO.	AGES 40 AND OVER	NO.
Accidental drowning	1	Angina pectoris	1
Influenza	2	Apoplexy	5
Typhoid fever	1	Digestive diseases	2
		Influenza	2
		Kidney disease	1
		Liver cirrhosis	1
		Nephritis	1
		Pneumonia	2
		Poisoning accidental	1
		Suicide	1
		Ulcer of stomach	1
Total	4	Total	18
Average Diastolic Blood Pressure of those who died—101 mm.		Average Diastolic Blood Pressure of those who died—99 mm.	

NOTE

During the same period, 164 applicants were accepted with a Diastolic Blood Pressure under 61 mm.—No deaths.

Also 43 applicants where the Pulse Pressure was under 26 mm. or above 54 mm.—One death. Cause of death—Syphilis. No record of syphilis at time of approval.

TABLE II

THE NORTHWESTERN MUTUAL LIFE INSURANCE COMPANY ACCEPTED RISKS WITH PALPATORY SYSTOLIC BLOOD PRESSURE OF 100 MM. AND UNDER TO OCTOBER 1, 1920

	Ages at Entry				*All Ages at Entry*	
	16–34		35–60			
Years	No.	Deaths	No.	Deaths	No.	Deaths
1912	5	0	4	0	9	0
1913	170	2	56	1	226	3
1914	150	2	45	1	195	3
1915	133	2	41	0	174	2
1916	292	3	81	1	373	4
1917	319	6	104	2	423	8
1918	208	1	140	1	348	2
1919	610	2	282	2	892	4
1920	521	0	228	0	749	0
Total	2408	18	981	8	3389	26

CAUSES OF DEATH *Ages 16–34*	NO.	CAUSES OF DEATH *Ages 35–60*	NO.
Casualties	6	Casualties	2
Influenza-pneumonia	7	Influenza-pneumonia	3
Pleurisy	1	Liver disease	1
Stomach disease	1	Pericarditis	1
Tuberculosis	2	Sudden death	1
Unknown	1		
Total	18	Total	8

TABLE III

THE NORTHWESTERN MUTUAL LIFE INSURANCE COMPANY ACTUAL MORTALITY BY LIVES TO ANNIVERSARY IN 1919, AS COMPARED WITH EXPECTED ACCORDING TO THE M.-A. AND A.-M. TABLES

Mortality of Accepted Risks with Palpatory Systolic Blood Pressure of 140–149 mm. with an Average of 142.43 mm.

Ages 40–60, Inclusive

Years	No.	Expected	Actual	Expected	Per Cent.	Per Cent.
		M.-A		A. M.	M.-A	A. M.
1907	208	32.263	32	33.169	99	96
1908	642	91.945	89	94.347	97	94
1909	944	111.754	108	114.627	97	94
1910	816	86.657	81	88.027	93	92
Total	2610	322.619	310	330.170	96	94
Ages at Entry						
45–53	1340	159.693	167	167.568	105	100

TABLE IV

Mortality of Accepted Risks with Palpatory Systolic Blood Pressure of 150 mm. and Over with an Average of 152.58 mm.

Ages 40–60, Inclusive

Years	No.	Expected	Actual	Expected	Per Cent.	Per Cent.
1907	83	13.032	23	13.237	176	174
1908	202	31.705	37	32.473	117	114
1909	169	23.980	19	24.461	79	78
1910	66	8.425	11	8.457	131	130
1911	8	1.136	2	1.159	176	173
1912	1	.183	0	.195	0	0
1913	3	.380	2	.339	526	590
Total	532	78.841	94	80.321	119	117
Ages at Entry						
45–53	283	36.356	52	38.290	143	136

THE NORTHWESTERN MUTUAL LIFE INSURANCE COMPANY

CAUSES OF DEATH

Table III		Table IV
23	Cancer and Sarcoma	5
4	Diabetes	2
1	Fever—Typhoid	1
2	Influenza	1
5	Rheumatism	4
6	Tuberculosis—Pulmonary	0
1	Tuberculosis—other than Pulmonary	0
11	Miscellaneous	4
53	Total General Diseases	17
35	Apoplexy and Softening of Brain	9
2	Meningitis	1
6	Insanity	0
2	Miscellaneous	1
45	Total Nervous Diseases	11

THE NORTHWESTERN MUTUAL LIFE INSURANCE COMPANY—*Continued*

CAUSES OF DEATH

Table III		Table IV
23	Angina Pectoris	7
14	Pericarditis and Endocarditis	4
27	Organic Heart Disease	9
16	Arteriosclerosis	6
2	Miscellaneous	0
82	Total Circulatory Diseases	26
1	Pleurisy	0
19	Pneumonia	6
1	Miscellaneous	0
21	Total Respiratory Diseases	6
7	Appendicitis	2
1	Intestines—disease of	0
7	Liver—disease of	2
6	Stomach—disease of	4
2	Miscellaneous	0
23	Total Digestive Diseases	8
3	Bladder—disease of	0
37	Nephritis	15
3	Prostate—disease of	3
43	Total Genito-Urinary Diseases	18
22	Casualties	4
14	Suicide	2
7	Miscellaneous	2
43	Total Violent Deaths	8
310	Grand Total	94

Dr. Fisher—I should like to ask Dr. Rogers how he and Mr. Hunter arrived at the conclusion that 15 mms. above and 15 mms. below marked the risk as a normal risk. In their paper of last year, they stated that they had arrived at the conclusion that 15 mms. above or below was the borderline.

Dr. Rogers—The fact of the matter is, Dr. Fisher, that we had made a considerable number of observations in our office of people who were in apparently good health, as to their blood pressure, and we came to the conclusion that about 15 mms. of mercury on either side represented the probable limits of health. I do not believe that any of us, excepting Dr. Fisher, knows enough about blood pressure yet, to say exactly where to

draw the line. We had to draw it somewhere, and we drew it at 15 mms. Our studies were fragmentary, and not as statistical as we should have liked to have them.

Dr. Fisher—This is the first time, I think, that Dr. Rogers has admitted that 15 mms. above marked the borderline. I never heard him express an opinion before as to the number of mms. below the average which marked the borderline. I have here risks that have been accepted by the Northwestern, numbering 3389 all ages, 16 to 60, where the blood pressure was 100 and below. 2408 were under age 35. After eliminating the deaths from influenza, pneumonia, and casualties, there were eight deaths from other causes. It has been estimated that including deaths from all causes the mortality was about 35% of the expected. I should like suggestions along the lines of the diastolic pressure.

Dr. Rogers—I should like to ask Dr. Fisher how many diastolics in that group were over 100.

Dr. Fisher—There were not many. There were about 51 over 110, and only one death where the diastolic was as high as 110, in 1244 cases.

Dr. Weisse—Dr. Fisher raises the point whether or not there are any instructions to the committee with reference to the investigation of diastolic pressure. If any member has anything to suggest along those lines we will be glad to hear from him.

Dr. Fisher—I have tried to get an expression at a previous meeting from the Association, as to just what point we should require the diastolic pressure. Nothing was arrived at. I feel that this is the only way to get any knowledge on the subject. I think there are other companies in quite as good position as the Northwestern to furnish information along this line, and in fact along the line of high systolic. The New York Life no doubt have thousands of cases upon their books. I have said nothing here in regard to our experience in the past five years on the high systolic, for the reason that we are not investigating as to the causes of death. As you all know, it is a very difficult thing to secure information in regard to declined

risks, and the only way we can do it is to furnish our examiners and agents with the names of those persons who have applied, and with the names of their physicians, and then we do not always get the information. I will say this, however, that from our investigations so far, I am inclined to believe our mortality is going to be quite as high as in our 1915 report, especially as to ages 40 to 50.

Dr. Root—I should like to ask Dr. Fisher if he gives his examiners instruction to take the diastolic pressure at the fourth or fifth phase.

Dr. Fisher—We have instructed our examiners to take the diastolic pressure only by the auscultatory method, and to take it at the last loud tone which usually occurs at the end of the third or the beginning of the fourth phase. These diastolics have all been taken by doctors in whom we have perfect confidence and who understand taking the diastolic by auscultatory method.

Dr. Weisse—A motion is in order to accept the report of the Blood Pressure Committee.

Dr. Rogers—Mr. President, I should like, in making the motion that Dr. Fisher's report be accepted, to offer a resolution of thanks to Dr. Fisher and his Committee of One, for their very excellent contributions to our information on the subject of blood pressure.

The motion was seconded by Dr. Beckett and carried.

Dr. Fisher—Can we not have a little discussion as to this question of diastolic? Am I along the right lines in my investigations of the diastolic pressure?

Dr. Rockwell—Mr. President—Dr. Fisher's figures would perhaps be at some divergence from those of my own particular Company because of the point at which he takes the diastolic. All cessation of sound appears to be something rather definite, whereas so long as there is any sound continuing there is apt to be a difference of opinion with the individual observer as to

which is the last loudest distinct sound. It has been the custom of my Company for some time past to instruct its examiners using the auscultatory method to regard the diastolic at the cessation of all sound, realizing that that may not perhaps be strictly correct scientifically, but it is something definite, and affords a common platform on which we can all stand.

Dr. Rogers—I should like to say, Mr. President, on behalf of the New York Life, that we send our examiners instructions to give us the diastolic just as the sound ceases. As Dr. Rockwell says, that is a pretty definite point. It also explains the difference that I have noted in Dr. Fisher's findings and such fragmentary observations as we have made on the subject. His diastolics seem to be rather high. I have known the difference between the clear sound and the cessation of all sound to be as high as 15 mms., and I fancy that Dr. Fisher's results should be read by all of us with reference to the difference of opinion between Dr. Fisher and some of the rest of us as to what constitutes the diastolic point. I do not think it lessens their value, but they should be so interpreted. When Dr. Fisher said he had taken diastolics as high as 110, I confess I felt a little goose flesh, and when he read his results, I was surprised. I do not believe that with diastolics taken at the cessation of sound as the marking point, a life company is going to get away with insuring risks of that sort on any such favorable terms as are indicated in Dr. Fisher's report. Personally, I regard as a pretty serious matter a diastolic of 110. I have talked with a number of clinicians on the subject, and their testimony is uniform, that using the cessation of sound as the marking point, when you get above 100 you are getting into deep water. I believe 110 is perilous, but when you interpret that to mean 100, as it might very well do in some of the cases included in Dr. Fisher's group, it still leaves us ground for feeling that perhaps we are not so far out of the way in drawing the line at 100 for the diastolic, assuming that the diastolic is marked at the cessation of sound instead of at the cessation of the loud taps.

Dr. Toulmin—Mr. President—We also instruct our ex-

aminers to read the diastolic with the disappearance of sound. I think it is very important, when we compare our results with those of any other Company, that we know just what the interpretation of the diastolic is. I think we should all try to assist Dr. Fisher and his committee in combining the mortality results from the view point of blood pressure.

Dr. Fisher—Mr. President—My objection to the cessation of all tone is that the doctor is waiting to see whether there is some more tone there and he loses a good many mms. before he finds it. The readings in a great many of these cases were taken at the Home Office, and I think that if you will practise it, you will find that you will get a more definite point as to the reading of the diastolic if you take the cessation at the last loud tone, at the end of the third or the beginning of the fourth phase.

At Dr. Rockwell's suggestion, the President asked for a rising vote of those members who instructed their examiners to take the diastolic at the cessation of all sound; and of those who instructed their examiners to take the diastolic reading at the last loud sound.

Dr. Weisse—Apparently a very large majority of the Companies represented here this morning instruct their examiners to take the blood pressure reading at the disappearance of sound, and not at the last loud sound.

Dr. F. L. Wells—Mr. President—Our Company must be unique in the fact that we take the record at both places, both at the change of tone and at the loss of sound.

Dr. Fisher—Mr. President and Gentlemen—You all know of the Mayo Clinic at Rochester. The Northwestern has been very closely identified with that clinic, in fact the father of the Mayo Brothers was our examiner, the boys have been our examiners and many of the members of the clinic. They have been very kind in giving us any information we called for in

our statistical work. For some time my attention has been called to death claims where the deceased had consulted the Mayos, and in a great many cases where an operation had been performed. In one case recently, for instance, the cause of death was cancer of the stomach. The Mayos had operated for ulcer of the stomach about two years prior to that time. I wrote to Dr. Judd, and called his attention to the fact, giving him the name, date of birth, residence etc., of the deceased, and I asked him if that information would be of value to them. He was very enthusiastic, and said that it would be of great value, and that it was just such information as they needed. It occurs to me, therefore, that where the attention of a Company is called to an operation performed by the Mayos, that we could give them the information, the cause of death, date, etc. They were very kind to this Association in turning over their records to Mr. Hunter, when he was investigating as to ulcer of the stomach, etc. I hope you will all make a mental note of this, because I know that Dr. Judd was most enthusiastic over my suggestion, and I think it would be a splendid thing not only for the insurance companies, but for the medical fraternities at large.

Dr. Fisher moved that the associated Companies be requested to notify Dr. Judd of the Mayo Clinic, when they receive death claims showing a history of former operation by the Mayo Clinic, and that the Secretary be requested to send a copy of those resolutions to the Mayo Clinic. Motion seconded by Dr. Willard.

Dr. Grosvenor—Why not make that cover cases that are operated on in other very well-known hospitals?

Dr. Rogers—The Mayo Clinic is the only institution that has contributed its data to this Association.

Dr. Beckett—I think that any well-gathered statistics are valuable to us, and there are many noted surgeons in this

country who are gathering these statistics, and in the compilation of papers we are getting the benefit of these statistics. I do not see why it would be any more trouble to us to report to Dr. Deever, or any one of the noted surgeons of the country who we know to be keeping statistics, than it would be to write to the Mayos, and I think we might well extend this same idea to other hospitals and surgeons as well.

Dr. Willard—We are doing this with the Mayo Clinic, because the Mayo people have placed so much information at our disposal, and have collaborated with this Association. Could we not, without going to any great formality in the matter or bringing a great deal of work upon ourselves, advertise the fact, by publications in proper medical journals? We could acquaint well recognized hospitals, and noted surgeons, with the fact that we should be glad to coöperate with them in case they are anxious to receive information about former patients on whom operations have been performed, and whose death claims have been presented to our Companies. If we do that by means of an article in any one of the large medical journals will we not show our disposition to help anyone who wants help? If we get into elaborate conferences with different organizations, it may take a lot of time, and it is possible that very few people go to the trouble of keeping statistics as accurately as do the Mayos.

Dr. Rogers moved that the whole matter be referred to a committee appointed by the Chair, with authority. Dr. Symonds seconded the motion. Dr. Fisher withdrew the first motion, and the second motion made by Dr. Rogers was carried.

Dr. Weisse—The first paper which presents for our consideration at this meeting, is the one by Dr. Brandreth Symonds, Chief Medical Director of the Mutual Life Insurance Company, on "The Value of the Medical Examiner's Opinion." This paper, like

each one which Dr. Symonds has presented to the Association heretofore, is worthy of deep study and will be discussed from both the medical and actuarial viewpoint.

THE VALUE OF THE MEDICAL EXAMINER'S OPINION.

By Brandreth Symonds, A.M., M.D.
Chief Medical Director Mutual Life Insurance Company of New York.

57 = 73

Into the selection of risks for life insurance enter a number of factors, medical and others. The value of each factor is problematical. Some thirty years ago the President of one of our great companies said that by the simple process of insuring everyone who walked past the doors of his Company's building on Broadway a mortality would be obtained as low as by the most careful selection then prevalent. Possibly he was right, and that without any reflection on the medical department or other forces instrumental in selecting the risks for his Company. The people walking on that part of Broadway at that time were almost entirely men between 16 and 65, in sufficiently good health to walk 3 or 4 miles an hour. They were financially in at least fair condition as the dead-line was fixed at Fulton Street, and for that same reason most of the men below Fulton Street were of good habits. A few years later the President of another great Company located on Broadway actually made an experiment similar to this by selling small amounts of insurance almost directly to the applicant through little toy banks which could be picked up in the "L" stations and elsewhere. There was no medical examination and practically no investigation. The results of this experiment which lasted for several months have never been published but the Company very suddenly withdrew the privilege, and bought up most of the outstanding policies.

In recent years a vast amount of insurance has been issued

on the group-plan. There is no medical examination of the individuals comprising the group but the medical characteristics of the group as a whole are carefully studied beforehand and in many groups the individuals are urged to maintain their vitality through lectures and pamphlets on sanitation and hygiene. The group primarily is demonstrated to be composed of healthy individuals and elaborate precautions are taken to prevent a group from deteriorating in its composition after insuring. The new cases which enter the group must be up to the original standard of work and capability, and the withdrawals include a large proportion of those who have become unfit for insurance. Unless these conditions are fulfilled, the mortality experience in the group is liable to be bad.

When a medical examination is made for life insurance, the duty of the medical examiner comprises at least two functions, (1) his detection of physical impairments, whether organic or functional, and (2) his ability to extract from an unwilling witness accurate knowledge of past diseases, the family history, habits, etc. For the proper exercise of both these functions a good deal of common sense is mixed with medical skill and knowledge. He knows what impairments have practically no influence on mortality, such as flat feet, cardio-respiratory murmurs, etc., and does not cumber his report with details of inconsequential trifles. He knows that apparent disturbances of function, such as persistent albumin and persistent irregularity of pulse have a bad influence on mortality, and that organic murmurs of the heart, present evidence of tuberculosis, etc., have a worse effect. This knowledge comes in part from the general prognosis learned in medicine and in part from the special information taught by life insurance companies. This latter item could be made of increasing value by a wider publicity of the papers read at the meetings of our Association and other similar organizations. As a result the medical examiner knows that certain classes of functional and organic defects are not usually acceptable for standard insurance.

In the Mutual Life Insurance Company of New York the

medical examiner's report has contained for many years a question which reads as follows:

"Do you without reservation unqualifiedly recommend the applicant for life insurance?" The wording of this question has changed almost none from the time it was instituted in the seventies. The medical examiner's answer has been affirmative in the vast majority of cases, ranging from 94% to 97% approximately. In a small minority of 3% to 6% he answers it in the negative, or suggests postponement, or very rarely qualifies an affirmation by such an expression as "yes, except for heart murmurs, ""yes, except for family history," etc. We have kept record of these cases for many years, and when the application has been finally rejected or postponed, we have entered these cases under the sub-heading "Disapproved by the Medical Examiner." It must be understood that not all of these suggestions of the medical examiner are immediately adopted by the Company. Sometimes he makes his suggestions for postponement after having detected an irregular pulse only once, or after having found albumin in only one specimen. In some of these cases the condition may be cleared up on subsequent examination and the risk accepted for standard insurance, the only kind of insurance that we issue. In such cases the examination is not counted as "Disapproved by Examiner" but the number of these is very small. In other words we first determine the risks that are rejected or postponed and then we make a separate category of those that are "Disapproved by Examiner." In a way this represents the medical examiner's opinion of the non-insurability of a risk. How valuable is that opinion? Some companies regard it as of no value and merely ask the medical examiner to be a faithful reporter of the conditions found by him. Others evidently attach much weight to it and ask the examiner whether the risk is good, fair, poor or bad. Many however content themselves with a question similar to the one asked by the Mutual Life. They doubtless treat a negative answer, as we do, with great respect, even if a risk is occasionally accepted in spite of it.

It occurred to me that it might be possible to determine the value of these opinions of the medical examiners regarding the non-insurability of risks by correlating their results with the mortality for the first and subsequent years. Correlation may be defined as the determination of the relationship between two sets of numbers with a view to causality. It may be estimated by means of diagrams or graphs or numerically. When it is estimated numerically, Galton's method is the one usually adopted. This gives a plus coefficient when the two sets of figures rise and fall in unison, and a minus coefficient when one set of figures rises as the other falls. If there is no correlation, the result is zero.

A perfect positive correlation is indicated by a coefficient of $+1$ and a perfect negative correlation by a coefficient of -1. In addition it is always advisable to determine the probable errors not only of the coefficient of correlation but of all the other constants which are determined in the course of the calculation. If the coefficient of correlation is three or more times its probable error, there is strong reason to assume a causal relationship between the two sets of numbers, and this likelihood increases *pari passu* with the difference which separates the coefficient of correlation and the probable error. When the numbers to be compared are few it is possible for the coefficient to be fairly large with very little real correlation, and likewise for the coefficient to be fairly small although there may be substantial correlation. For both these reasons it is important to check up the numerical results by means of graphs and this has been done in all cases.

The following table shows the array of items which entered into the calculation. In column (1) are the years of issue. In column (x) are the percentages of those applications which were "Disapproved by Medical Examiner," as previously described in this paper. In column (a) are the mortality ratios on applications for policy year one, calculated in accordance with the method of the Medico-Actuarial Mortality Investigation. In column (b) are the mortality ratios for policy year two, in (c) for policy year three, in (d) for policy year four, in

(e) for policy year five, in (a-e) for the five policy years one to five together, in (f-j) for the five policy years six to ten together, omitting one year of issue for each policy year as the exposure terminated in 1909.

TABLE I

(1) Years of Issue	(x) Disapproved by Medical Examiner	(a) Policy Year One	(b) Policy Year Two	(c) Policy Year Three	(d) Policy Year Four	(e) Policy Year Five	(a–e) Policy Years One-Five	(f–j) Policy Years Six-Ten
1893	2.71	95.05	106.67	100.99	101.19	119.66	104.18	108.01
1894	3.30	88.43	78.80	110.55	102.90	91.05	93.35	102.93
1895	3.03	91.02	91.30	108.46	106.80	104.55	99.85	107.27
1896	2.84	104.69	97.38	121.29	103.28	113.86	107.88	99.26
1897	2.93	98.60	106.86	101.48	92.94	104.20	100.74	96.67
1898	2.84	105.74	90.57	124.14	95.53	111.80	105.49	98.67
1899	2.83	107.72	117.34	116.31	93.65	104.31	107.88	98.35
1900	2.99	100.35	95.39	87.21	101.46	96.14	96.15	92.08
1901	3.13	99.16	86.09	108.37	87.84	91.88	94.70	93.54
1902	3.22	87.15	92.46	88.12	90.92	92.30	90.15	85.33
1903	3.30	100.49	99.69	80.94	97.46	94.06	94.62	
1904	3.58	92.38	85.44	100.02	95.20	88.25	92.23	
1905	4.72	98.42						
1906	4.76	109.59						
1907	4.53	72.28						
1908	5.05	64.93						
1909	4.74	57.52						
1910	4.99	55.92						
1911	4.87	69.12						
1912	4.92	58.53						
1913	5.04	55.26						
1914	5.23	52.11						
1915	5.21	48.83						
1916	5.03	61.26						

It will be noticed that the years of issue have been divided into two sections, an older period from 1893 to 1904 and a recent period from 1907 to 1916. The years 1905 and 1906 have been omitted entirely from the calculation, for they were the years of the insurance investigation and very abnormal in many ways, too numerous to mention now.

We will first discuss the older period from 1893 to 1904. As column (x) is to be correlated with each of the subsequent

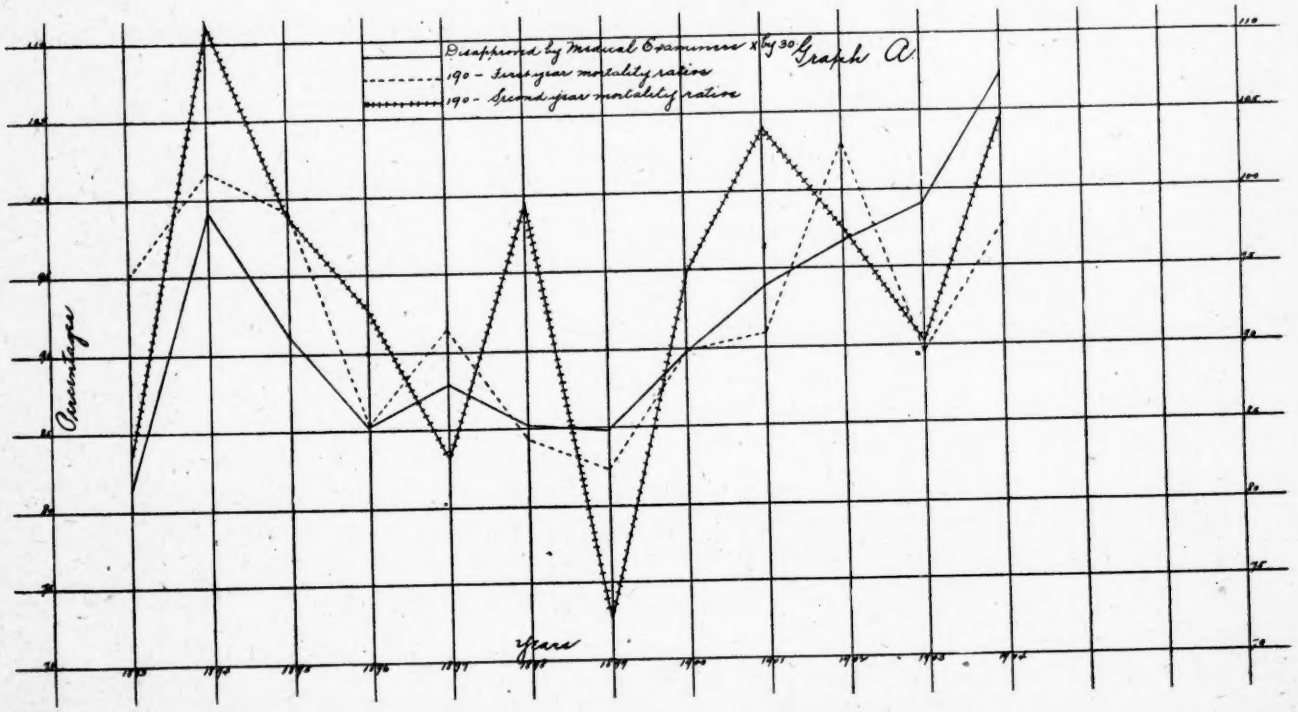
columns, it will simplify matters to set forth the constants for (x) once for all. The mean for (x), the older period, is 3.06 — ±.047. The standard deviation is .243 ± .033 and the variability is 7.9 ± 1.1. In the following table is set forth the results of correlating (x) with each of the subsequent columns. Column (1) shows the column of Table I which is correlated with (x). Column (2) shows the coefficient of correlation with its probable error. Column (3) shows the mean, column (4) the standard deviation, and column (5) the coefficient of variability.

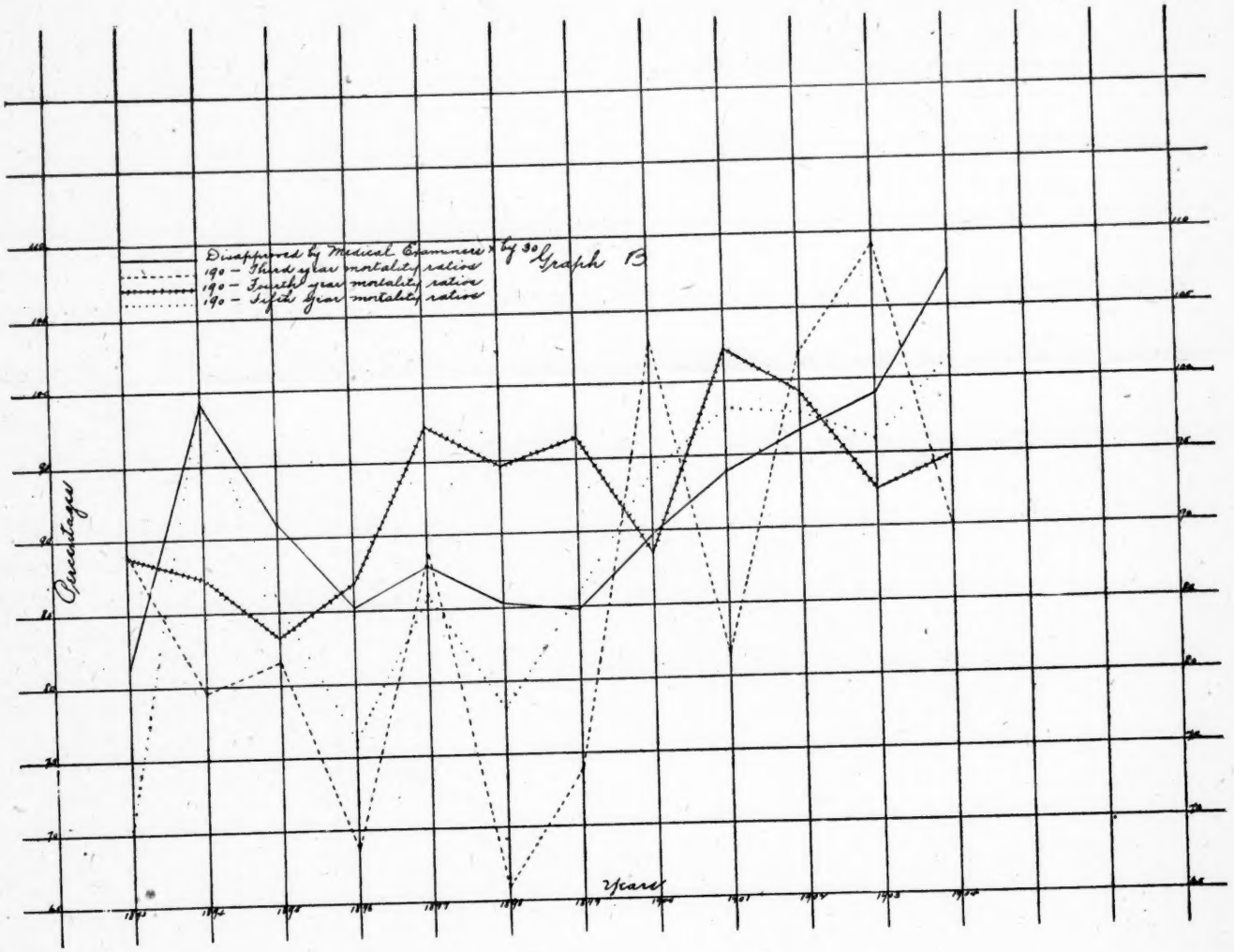
TABLE II

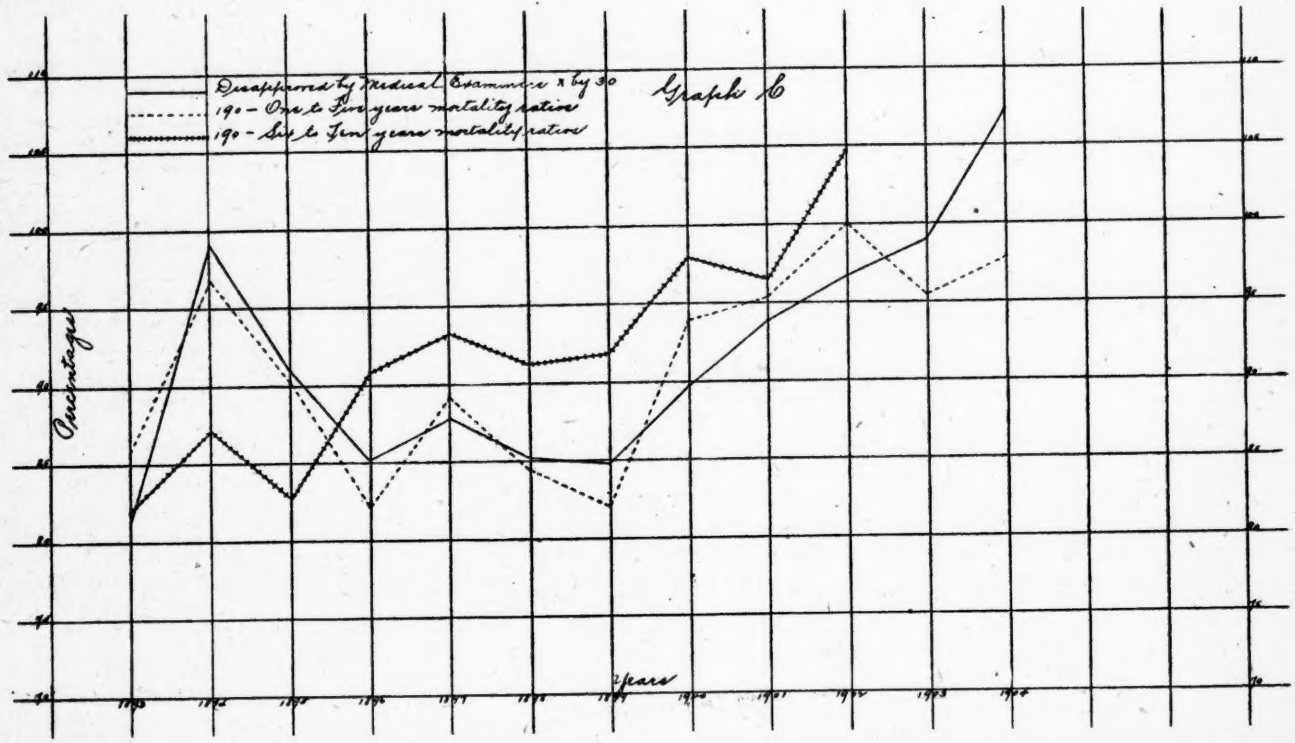
(1) Correlation of (x) with	(2) Coefficient of Correlation	(3) Mean	(4) Standard Deviation	(5) Variability
(a) 1st Year	− .563 ± .133	97.57 ± 1.268	6.511 ± .896	6.7 ± .9
(b) 2d "	− .632 ± .117	95.67 ± 2.004	10.293 ± 1.417	10.8 ± 1.5
(c) 3d "	− .445 ± .156	103.99 ± 2.536	13.023 ± 1.793	12.5 ± 1.7
(d) 4th "	− .178 ± .189	97.43 ± 1.066	5.475 ± .754	5.6 ± .8
(e) 5th "	− .887 ± .042	101.01 ± 1.911	9.816 ± 1.351	9.7 ± 1.3
(a–e) 1–5 Years	− .853 ± .053	98.94 ± 1.169	6.002 ± .826	6.1 ± .8
(f–j) 6–10 "	− .407 ± .178	98.21 ± 1.398	6.553 ± .988	6.7 ± 1.0

Column (2) is the one of interest to us. It will be noticed that every coefficient of correlation bears a minus sign, showing that the correlation is negative. This means that as the percentage of "Disapproved by Medical Examiner," increases, the mortality ratio for that year of issue decreases. Frankly this was a surprise when first noted, for the view had prevailed that an increased percentage of "Disapproved by Examiner" meant that a larger volume of poor business had been presented to the Medical Examiner and therefore it was probable that the mortality would be high.

If we take up the individual years it will be noted that the coefficient of correlation for the first policy year (a) is more than four times its probable error. For the second policy year (b) it is more than five times its probable error and for the


Graph A
Disapproved by Medical Examiners x by 30
190- First year mortality ratios
190- Second year mortality ratios
Percentages
Years


Disapproved by Medical Examiners
190 – Third year mortality ratios
190 – Fourth year mortality ratios
190 – Fifth year mortality ratios
Graph B
Percentages
Years


Graph 16
Disappeared by Medical Examiners x by 30
190 - One to Five years mortality ratios
190 - Six to Ten years mortality ratios
Percentages
Years

third policy year (c) it is nearly three times its probable error. For the fourth policy year (d) it is less than its probable error, indicating a very poor correlation in that year, but for the fifth it jumps up to 20 times the probable error. For the first five policy years (a–e) the coefficient of correlation is fifteen times the probable error. Even for the next five policy years (f–j) it is two and a half times the probable error, and in view of the record of the previous years, that should be regarded with some respect.

That these results are due to a spurious correlation is very doubtful, since they are fairly uniform with such discrepancies as would naturally occur. In order to make sure however we can check them up by means of graphs. In order to bring the two sets of percentages in closer approximation, it is necessary to increase the smaller set. This is done for the earlier period by multiplying the "Disapproved by Medical Examiner," column (x) in Table I, by 30. The numbers in (x) are thus made to approximate in magnitude the numbers in (a), and the subsequent columns in Table I. Since (x) goes up as (a) goes down, it is much easier for the eye to appreciate the correlation between them by inverting (a) and this is done by subtracting the figures in (a) from 190. Graph A shows these changes. The continuous line indicates the "Disapproved by Medical Examiners" (x multiplied by 30), the broken line shows the mortality-ratios of the first policy year (190-a), and the crossed line the mortality-ratios of the second policy year (190-b). In graph B the broken line shows mortality-ratios of the third policy year (190-c), the crossed line those of the fourth policy year (190-d) and the dotted line those of the fifth policy year (190-e). In graph C the broken line shows the mortality-ratios of policy years 1–5 (190- (a to e) and the crossed line the mortality-ratios of policy years 6–10 (190- (f to j).

In all these graphs the correlation between the heavy continuous line which indicates the "Disapproved by Medical Examiner," and the other lines is marked. As the one rises and falls, so do the others in most cases, with the exception of the fourth policy year (d). This coincident rise and fall is

occasionally interrupted in the other policy years by a reverse current but this is exceptional. Altogether the correlations shown by the curves are close and quite as good as those by Galton's formula.

When the recent period, 1907–1916, is studied, it is evident that the two factors have quite different values from those in the older period, 1893–1904. The cases "Disapproved by Medical Examiner" have increased from about 3% to about 5%, and the mortalities of policy year 1 have decreased from an average of 97.57% to 59.58%. These changes are well shown in Table I. The years 1905 and 1906 have been omitted entirely from this study. That was the time during which the Armstrong Investigation was under way and the New York Life Insurance Companies passed through very abnormal conditions. In 1907 the new laws went into effect, and our mortalities began to assume their present values, which are on a much better plane than before.

The increase in the "Disapproved by Medical Examiner" was due to another cause. Towards the end of the last century the Mutual Life initiated a plan of salaried examiners in the larger cities and this was extended until 1903. The plan had merits but considerable friction developed with the agents in some places, and in the latter part of 1903, it was decided to abolish the salaried medical examiners. At that time, as I was starting on a vacation, I wrote a letter to the Secretary of the Company, who had recently been a Medical Director, from which I quote:

"It may be that my poetical imagination has run away with me and that the whole scheme is nothing but an iridescent dream, but I feel so strongly that there is good merit in it that I want you to consider it carefully. The scheme is as follows: To put at the headquarters of every managing agency a medical man who has been trained to perform the following duties:

1. To examine the local applicants.
2. To inspect examinations which come in from the outlying territory and if they need correction or additional in-

formation to write to the examiner for it, at the same time forwarding the original examination, with a copy of his letter to the Home Office.

3. To have the power to release policies which have been sent out subject to medical restrictions.

4. To act upon the commercial agency reports in the same way as outlined in 2 and 3.

5. To nominate medical examiners in the outlying territory at the request of the Manager.

6. To make trips into the outlying territory for the purpose of examining large risks or to perform other duties as may be assigned.

The advantages of this plan are, it seems to me, most evident on its face. It will materially facilitate the dispatch of business in every way. It will shorten the time of mail service. It will insure prompter replies from the examiners. It will have great advántage with large applications made in small towns and will undoubtedly save some business which is now lost by reason of delay in getting it properly examined. Furthermore, it will probably save some business which may be turned down by examiners in the outlying territory, for the manager will be at liberty to bring them up for examination by the local medical referee. I do not see that there is any great difficulty to overcome. The disadvantages that may be urged against the plan are as follows:

1. Impracticability. While it may be difficult to train all the men needed for these positions, I cannot see any permanent obstacle in that. Certainly the plan can be carried out as far as possible and as rapidly as possible and while it may take some time to secure such service everywhere, it can be accomplished in time.

2. Expense. I am very sure that it can be put into effect without adding any expense beyond that now paid for examinations as calculated according to the present fee system.

3. The danger of collusions between the local referee

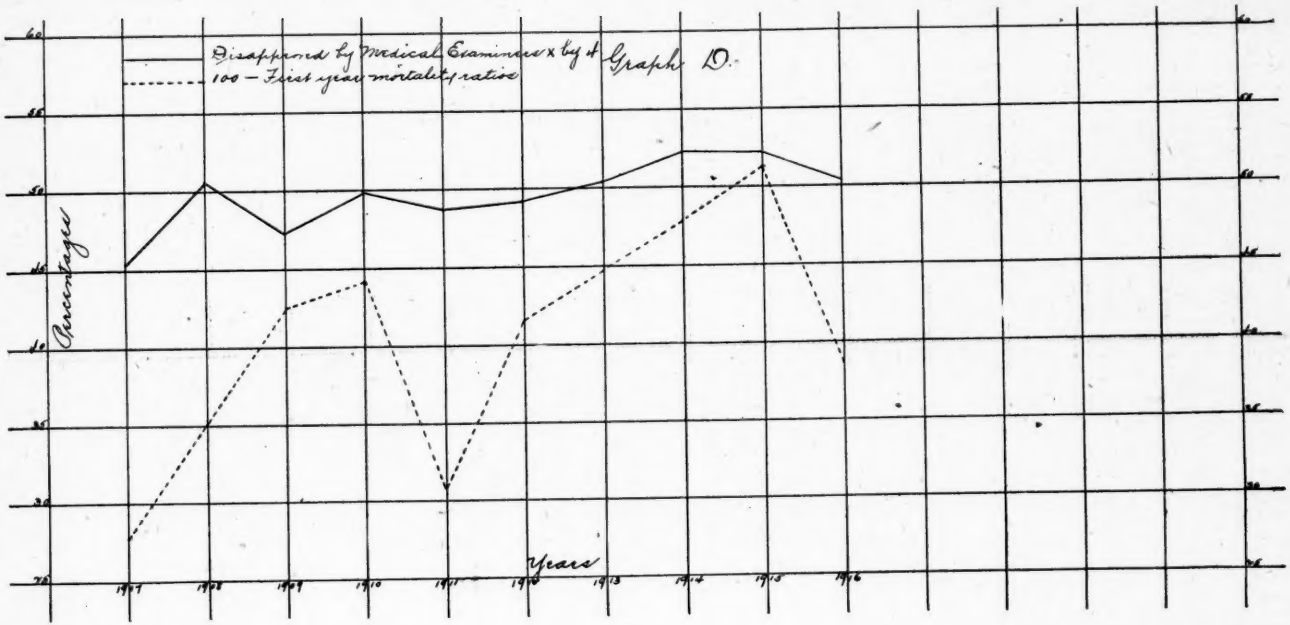
and a Manager. Certainly more damage could be done by such a collusion than is possible under the present system, but on the other hand these referees would be under closer observation than our present examiners.

I can see no drawback to the scheme other than those I have mentioned. Doubtless there are others, but they do not occur to me. The scheme is for the material benefit of the agent, and he is the one who will profit most largely and most directly by it. So far as my share is concerned it means a good deal of hard work for a few years, and from the point of self-interest it is perhaps unwise in me to urge its adoption, but I firmly believe that it will prove of great benefit to the agent and to the Company. It is at present on trial at Milwaukee and seems to be working first rate.

These suggestions were promptly adopted by the Company and we began to appoint Medical Referees on this basis as fast as we could train them. Each one received a thorough course in examining applicants and general instruction in the selection of risks at the Home Office. He made a very large proportion of the examinations in the agency city. By constant correspondence with the other examiners, he improved their knowledge of selection. Our staff of medical referees was practically completed by the end of 1906. Most of the increased percentage of "Disapproved by Medical Examiners" can be ascribed directly and indirectly to them, though some of it is doubtless due to improved medical training in general. A fraction of the gain is due to the increased volume of the business in New York City, where we have an excellent staff of medical examiners under Dr. Porter.

The correlation of the recent period is limited to policy year 1, for it was found that subsequent policy years were affected by the influenza epidemic. The coefficient of correlation is $-.751 \pm .093$. This is an excellent result and strongly corroborates the previous findings.

Graph D shows the factors in diagram. The "Disapproved by Medical Examiner" has been multiplied by 10 and the


Disapproved by Medical Examiner x by 4
100 – First year mortality ratio
Graph D.
Percentage
Years
60
50
40
30
20
1907
1908
1909
1910
1911
1912
1913
1914
1915
1916

mortalities have been subtracted from 100 in order to invert them. The lines move in unison with the exception of the year 1909.

The correlations heretofore have all been based upon consecutive years of issue. Owing to varying conditions we have been obliged to drop out two years and to split our material into two periods. It may be thought that the element of consecutive time is a factor, and without it no correlation could be shown.

Since 1912 we have kept a record of the "Disapproved" for each Agency and we also have the mortality experience for each of the New York City Agencies for the same period. The correlation for the individual policy years was not particularly good. It was usually negative but always low and often as small as the probable error. This was probably due to the small number of deaths annually in each Agency. When all the policy years $-6-$ were combined the correlation showed better both arithmetically and graphically. The array is set forth in the following table.

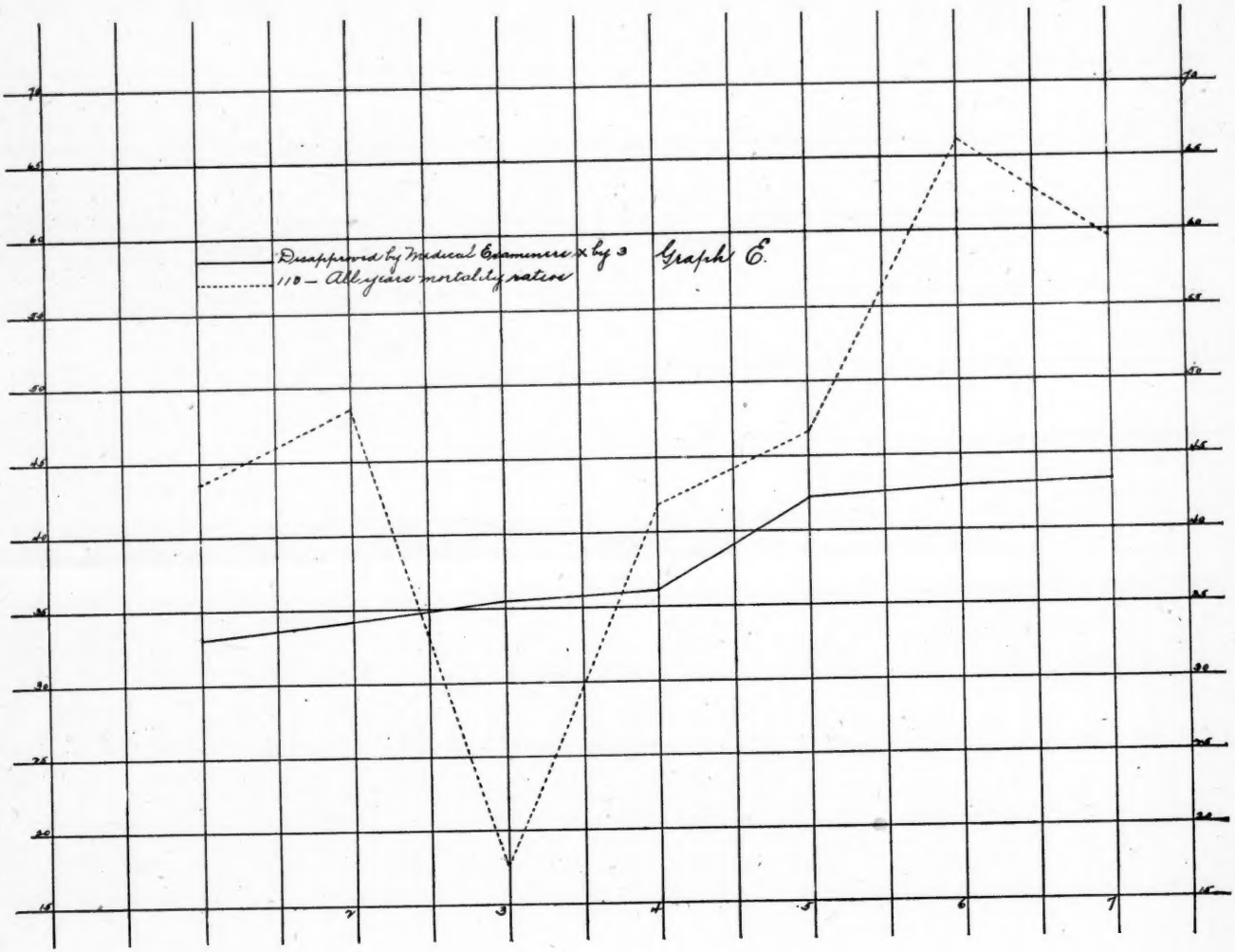
TABLE III

Agency	Disapproved by Examiner for the Years of Issue 1912–17	Mortality for the Issues of 1912–17 Exposed to 1918
1	11.0	66.5
2	11.4	61.5
3	11.8	92.3
4	12.0	68.1
5	14.1	63.3
6	14.3	43.8
7	14.4	50.4
Mean	$12.71 \pm .35$	63.70 ± 3.64
Standard Deviation	$1.38 \pm .25$	14.26 ± 2.57
Variability	10.90 ± 2.00	22.40 ± 4.00
Coefficient of correlation	$-.622 \pm .156$	

In graph E the correlation is not as good as we have heretofore had. The mortality of Agency 3 is extreme and against

the current but taking it altogether the lines will be seen to move in unison. It will be noted that the percentage of "Disapproved by Examiner" was very high from 11% to 14.4%. Our examining staff in New York is excellent and has been kept up to a high state of efficiency. A great deal of instruction in the selection of risks is given to them. We all know when an applicant is disapproved by any company in New York City that he is immediately passed around from office to office in the hope that he will ultimately be accepted. As a result an expert medical examiner in New York City has abundant material for disapproval. It will also be noted that the mortalities for the New York City Agencies were very low. Considering the quality of the business that is presented as shown by "Disapproved by Medical Examiner" the record is extremely good. For the period 1912–1917, there was a total of 465.71 expected deaths and only 296 actual deaths, giving a mortality of 63.5%. For a period of 1–5 policy years the entire experience of the Company was 70.5%. The two percentages are not strictly comparable but it gives an idea how good our selection in New York City has been, so far as the early hazards are concerned.

After the "Disapproved by Medical Examiner" has been deducted from the total disapproved by the Company, there is left a residue which has been approved by the Medical Examiner but for various reasons has been considered unacceptable. This residue is composed of some who have been rejected outright on account of family history, build, personal history of disease, injury, or operation: of some who have been postponed on account of a recent illness, injury or operation, or because of a functional disturbance such as albuminuria, intermittent pulse, etc.: of some whose finances, morals or occupation are too hazardous to warrant acceptance: and of a few others. This material therefore is very heterogeneous. I tried to correlate it with the mortalities of the first, and subsequent years but obtained no results of value. The coefficients of correlation were regularly low and often smaller than the probable error. They were usually plus for the first policy


Disapproved by Medical Examiners x by 3
110 – All years mortality ratios
Graph E.

year but after that they were sometimes minus. It is evident that the different components of the "Residue" antagonize and neutralize one another in the determination of correlation.

Lest it be said that a beautiful correlation has been overlooked, the coefficient of correlation for the first policy year of the entire period 1893–1916 is $-.811 \pm .047$. If the abnormal years 1905–1906 are omitted, it is $-.968 \pm .009$ which is very near the perfect correlation of -1. Someone would explain this by simply showing that the low percentages of "Disapproved" are associated with high mortalities in the earlier period and that the high percentages of "Disapproved" are associated with low mortalities in the recent period. This explanation is quite correct and therefore we would not get the correct numerical value of the medical examiners' opinion. It was evidently of different significance in the two periods and it is only by analyzing the two periods separately that we can learn its real value.

We wanted to find out whether the little deviation from the mean in the percentages of "Disapproved" affected the deviation of the same year in the mortalities. The answer is definitely in the affirmative and it can be said that the mortality rises when the percentage of "Disapproved" goes down and *vice versa*. The relationship of the two can be determined numerically by means of the equations of regression, or the characteristic equations as they have also been called. If we let x represent the "Disapproved by Medical Examiner," y the mortality, r the coefficient of correlation and s the standard deviation then $x = r\frac{sx}{sy} y$ and $y = r\frac{sy}{sx} x$.

By substituting the numerical values which have already been set forth in the previous pages, these equations become for the earlier period:

$$x = -.021\, y, \quad y = -15.1\, x$$

For the recent period these equations are:

$$x = -.021\, y, \quad y = -27\, x$$

These equations indicate that in both periods a change of .021 % in the "Disapproved" was associated with an inverse change of 1% in the mortality. In the older period a change of 15.1% in the mortality was associated with an inverse change of 1% in the "Disapproved" while in the recent period a change of 27% in the mortality went with an inverse change of 1% in the "Disapproved."

The preceding work has shown that there is a substantial correlation between "Disapproved by Medical Examiner" and the subsequent mortality, even up to the tenth policy year. This correlation is not perfect for there are many other factors which enter into selection. If the applications "Disapproved by Medical Examiners" are deducted from the total disapprovals, there is a residue which is composed of some who are postponed on account of recent illness, or on account of some physical impairment, such as albuminuria, cardiac arrhythmia, etc.; others who are rejected outright on account of physique, family record and personal history of disease. This residue as a whole showed no correlation with the subsequent mortality. Those cases which were only postponed showed a small positive correlation which in the earlier period amounted to .363 ± .169 for the first policy year. It was .143 ± .191 for the second policy year and this is practically no correlation. For the later period the correlation was .464 ± .167 for the first policy year.

As this positive correlation occurs in spite of the presence of 40% of Disapproved by Medical Examiner, which would regularly show a negative correlation, the reason of it must be sought elsewhere. Most of the postponed cases other than those Disapproved by the Medical Examiner are due to the fact that the applicant has recently had some acute illness. The crude death rate of the registration area may be regarded as a reliable index of the general morbidity, for when diseases are numerous, there is also apt to be an increase in fatalities. The correlation between the crude death rate of the registration area and the Postponed in the Mutual Life for the years of issue 1907 to 1916 is .686 ± .113. The correlation between the

crude death rate and the 1st year mortality for the same issues is .704 ± .108. In both cases the correlation is good and positive. It really seems as if the percentage of Postponed and the 1st year mortality were both due to the same cause, namely, the general morbidity of the country as expressed by the death rate of the Registration Area. The correlations for the 2d and 3d policy years were obtained by excluding the deaths due to influenza. There seems to be no valid reason for doing this. When they are included the correlation for the 2d policy year becomes .368 ± .184 and for the 3d policy year .044 ± .224. For the 2d policy year the correlation is not conclusive, since it is only twice the probable error, while for the 3d policy year there is no correlation at all.

The mortality also contains an element which no medical examination can forestall entirely. The deaths from accident, homicide, and suicide cannot be prevented by the most careful medical examination and likewise the deaths from acute diseases, such as typhoid, malaria, the exanthemata, pneumonia, appendicitis, etc. Probably a certain number of the cases whose deaths are recorded from these accidents and acute diseases had some antecedent chronic ailment which would have been found by careful examination. One who already has diabetes or heart disease is less apt to survive a severe injury or an attack of pneumonia than one who is in normal physical condition. It will prove of interest to find out just how large a factor of the normal mortality cannot be prevented even by the most skillful examiner.

The United States Life Tables are based upon the census of 1910 and the deaths of the years 1909, 1910, and 1911, as found in the Registration Area, which was then considerably smaller than at present and contained a very small proportion of the Southern and remoter Western States. The following table shows the method used to calculate the unselected mortality according to the United States Life Table for white males and the distribution of exposures for the first policy year according to the experience of the Mutual Life Insurance Company for the years of issue 1907–1916.

TABLE IV

U. S. AND CANADA—ISSUES OF 1907–1916—FIRST POLICY YEAR

(1) Ages	(2) Exposures	(3) U. S. Life Table White Male 1910 qx per 1000	(4) Expected	(5) U. Acute	(6) K. Non-Acute
15–19	30,431	3.98	121.12	62.62	58.50
20–24	78,341	5.40	423.04	210.25	212.79
25–29	81,072	5.82	471.84	211.86	259.98
30–34	69,404	7.31	507.34	201.41	305.93
35–39	57,092	9.23	526.96	194.98	331.98
40–44	43,219	11.04	477.14	155.55	321.59
45–49	28,319	13.66	386.84	115.67	271.17
50–53	13,875	16.53	229.35	59.17	170.18
54–56	6,593	21.50	141.75	30.76	110.99
57–59	3,795	26.81	101.74	22.08	79.66
60–62	2,047	32.95	67.45	12.28	55.17
63–65	1,007	40.88	41.17	7.49	33.68
66–68	582	50.23	29.23	4.56	24.67
69–70	200	59.58	11.92	1.86	10.06
Total	415,977		3536.89	1290.54	2246.35
Rate per 1000			8.50	3.10	5.40
Ratio of Expected by the U. S. Life Table to M. A. Table			188.9	68.9	120.0

The expected deaths (column 4) are those supposed actually to have occurred in the year 1910 and could with all propriety be called actual deaths. When they are compared with the expected deaths as calculated by the Medico-Actuarial Mortality Table, the mortality ratio is seen to be 188.9%. Column (5) headed "u—Acute" includes those deaths due to the acute general diseases, acute articular rheumatism, meningitis, pneumonia, appendicitis, homicide, suicide, and all the other forms of external injury based upon the mortality report of the Registration Area for the year 1910. Column (6) headed "k —non-Acute" includes all the other causes of death. The death rate per 1000 of exposures is 8.50 which is divided into u = 3.10 and k = 5.40.

As we have said before, some of the deaths under u could not have been foreseen by the Medical Examiner, inasmuch as the deceased had no chronic ailment prior to the fatal illness or injury. The following table shows this quite conclusively.

TABLE V

MUTUAL LIFE EXPERIENCE—U. S. AND CANADA—FIRST POLICY YEAR

	Issues of 1893 to 1904	Issues of 1907 to 1916	New York City 1912 to 1917
Exposures	592,839	415,978	27,976
Total Deaths	2,560	1,092	60
Rate per 1000	4.32	2.62	2.14
U, Acute	1,644	658	32
Rate per 1000	2.77	1.58	1.14
K, Non-Acute	916	434	28
Rate per 1000	1.55	1.04	1.00
% of Disapproved by Examiners	3.13	5.00	12.82

Even in the early period 1893–1904, the proportion of u has dropped from 3.1 among unselected risks to 2.772. In the next period 1907–1916 it drops to 1.581 and the percentage of "Disapproved by Medical Examiner" rises to 5%. In 1912–1917 in New York City it dropped to 1.143 and the percentage of "Disapproved by Medical Examiner" rose to 12.82%. In New York City the proportion of deaths from acute infectious diseases such as typhoid, malaria, etc., is distinctly lower during the insurance ages than in the country as a whole. It hardly seems fair therefore to take that ratio as a criterion to go by. The ratio of 1.581 found in the Mutual Life Experience of 1907 to 1916 which includes the year of the United States Life Table seems to approximate the truth. It is a trifle more than one half of the ratio found among unselected risks and probably could have been improved to just about that point. Let us therefore take 1.55 which is one half of 3.1 as equivalent to u. Then $k = 6.95$, as that represents the rest of the total deaths per 1000, 8.5.

Up to this time I had been struggling with an equation which looked good but which failed when put to the acid tests of zero and infinity. I therefore consulted Mr. John S. Thompson, one of our actuaries, and he struggled with the problem for several days. Then he brought forth an equation and with the remark that it could probably be fitted to the facts, he left for a month's vacation. At the same time our President began to wonder audibly when this paper was going to be ready. For the next three weeks life was just one fit after another and discarded fittings were blowing up all around for the reason that they were misfits. Finally a fit was achieved which I hope will prove of interest. Mr. Thompson's equation is as follows:

$$y - u = (x^2 + k)\, a^{-x}$$

Where

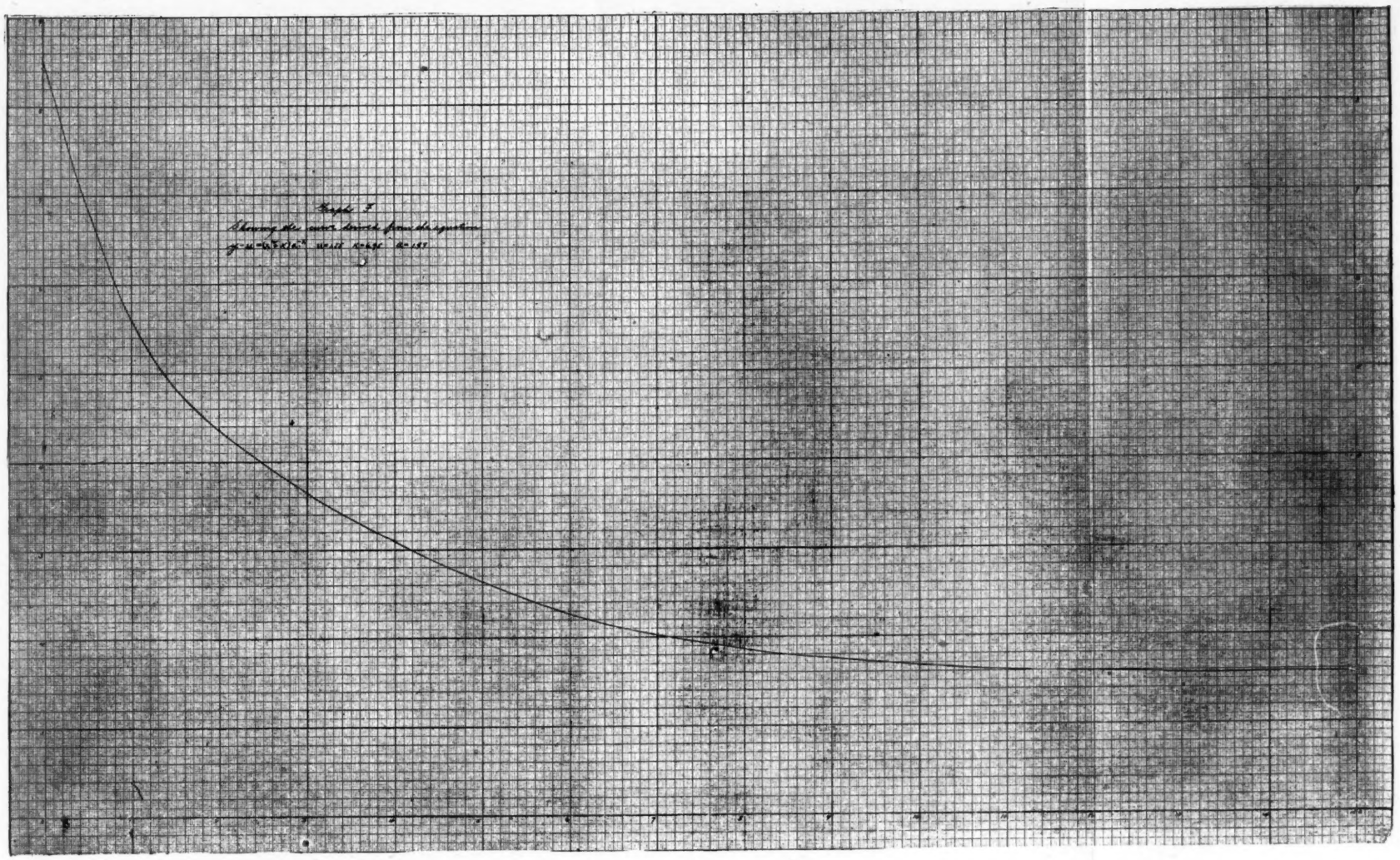
y = the total mortality as experienced in deaths per 1000 exposures. It is divided into u and k. Among unselected risks it is 8.5 per 1000 exposures.

u = That part of y which cannot be foreseen and prevented by the Medical Examiner. We have assumed that it is 1.55 per 1000 exposures.

k = That part of y which should be prevented more or less by the Medical Examiner. We assume that it is 6.95 per 1000 exposures among unselected risks.

x = The percentage of the applicants who were "Disapproved by the Medical Examiner."

a = a constant which might be termed the force of selection. In this equation $a = 1.97$ for the first policy year. Presumably it would be less for subsequent policy years. As its exponent is $-x$, its importance increases enormously as x increases for the expression a^{-x} is the denominator of the fraction whose numerator is $x^2 + k$. This seems right for the total disapprovals increase much more than the increase of those disapproved by the Medical Examiner only. The force of this expression a^{-x} is so great when a


Graph 7
Showing the outer bounce from the equation
$y = u - 0.5 \times 10^{-5} u^{2.11}$ with range $R = 151$

= 1.97 and x = 15 or any larger number that almost all the value of y is obtained from u which equals 1.55. This is a part of the equation which cannot be eliminated even if x becomes infinitely large.

Now that definite values have been assigned to u, k, and a, we can give varying values to x and then obtain the corresponding values of y. The following table shows this for integral values of x from 0 to 15, with the equivalents of y.

TABLE VI

Value of x	Equivalent of y	Value of x	Equivalent of y
0	8.500	9	1.747
1	5.586	10	1.671
2	4.371	11	1.624
3	3.636	12	1.594
4	3.074	13	1.576
5	2.627	14	1.565
6	2.285	15	1.559
7	2.036		
8	1.863		

Graph F shows the curve which these figures give. The values of x on the bottom are given, a unit to each full space. The values of y are on the left-hand side, a unit to each full space.

In the following table the actual facts are given upon which the fit has been made.

TABLE VII

(1) Value of x	(2) Theoretical Value of y	(3) Actual Value of y	(4) Exposures	(5) Actual Deaths	(6) Expected Deaths	(7) Ratio
2.38	4.062	4.034	50,814	205	223.212	91.8
3.13	3.556	4.320	592,839	2560	2637.222	97.1
4.40	2.882	2.784	90,893	253	416.366	60.8
5.00	2.627	2.625	415,978	092	1871.927	58.3
7.80	1.892	1.972	28,906	157	124.067	45.9
11.20	1.617	1.460	6,847	10	33.653	29.7
12.82	1.579	2.140	27,976	60	127.243	47.2

The headings of the column indicate the matter in each. The expected deaths (6) were calculated according to the Medico-Actuarial method. This column and also (7) were inserted simply to show the mortalities as ordinarily presented to a Medical Director, which correspond to the actual deaths per 1000 exposures as set forth in column (3).

The first line beginning 2.38 shows the results of a number of our Agencies whose percentage of "Disapproved by Medical Examiner" was below 3, and whose mortalities ran above our average in the recent period. These were nearly all rural agencies, scattered all over the country. The theoretical and actual values of y are very close.

The next line, beginning 3.13, represents the Mutual Life Experience in the older period, 1893–1904. It is not surprising that the actual value of y, .43182, is considerably larger than the theoretical value. Selection was quite different then from its present condition. We had a very liberal overweight standard, we accepted family records with two cases of tuberculosis freely on endowments, we had practically no system of inspecting our risks before we issued the policies. Summing it all up, we may say that the force of selection was substantially less than in the recent period. If we make $x = 1.78$ then the theoretical y for this period $= 4.3541$ which is very close to the actual figures. Now 1.78 is 19 points less than 1.97 the figure which we term the force of selection for the recent period. Approximately the force of selection was only nine tenths of its present value. This occurs too in spite of a fact which ought to increase x and therefore lower the theoretical value of a still further. During nearly all this period the Company was under the old system of General Agents. These did not like to swell their percentage of rejected applicants. In those days the Medical Examiner handed over his completed report to the agent. If the latter paid the fee to the Medical Examiner and then destroyed the disapproved application, nobody was the wiser and nobody very much cared. It was not until near the end of this period that it was made obligatory for the Medical Examiner to send his completed report directly to the Agency

Headquarters, whence they were all sent to the Home Office, and no agent was allowed to pay a fee to the Medical Examiner. If we could make a proper allowance for this the force of selection as represented by a would drop still further.

On the other hand it may be that the values of u and k are different in the earlier period. If we leave $x = 3.13$ and $a = 1.97$, but make $u = 2$ and $k = 8$, then the theoretical value of $y = 4.1314$, which is quite close to the actual value. This assumption, however, would make $y = 10$ when $x = 0$, i. e., among unselected risks in the population at large in the usual insurance ages.

The next line, beginning 4.40, shows the results of all of our Agencies whose percentage of "Disapproved by Medical Examiner" was 4 and below 5 in the recent period. Considering the limited number of actual deaths, the actual and theoretical values of y are close enough to call for no comment.

The next line, beginning 5, shows our entire experience in the United States and Canada for the recent period, 1907–1916. The theoretical and actual values of y are very close.

The next line, beginning 7.80, is the recent experience in a large city where we have only one Agency. Considering the limited number of deaths the approximation of the theoretical and real values of y is very close.

The next line, beginning 11.20, shows the experience in the recent period of another large city where we have only one Agency. The "Disapproved by Medical Examiners" are very large but the theoretical and actual values of y are in close accord. In fact this might be termed an ideal Agency. The Medical Examiners are faultless in their work and the management does not present to them any abnormal intrusions. The number of actual deaths is small but the mortality ratio as shown in column (7) is extraordinarily good.

The last line, beginning 12.82, shows the experience of our New York City Agencies. There is a large discrepancy between the actual and theoretical values of y. When $y = 2.140$ x ought to be 6.5. Apparently one half of the risks disapproved by our Medical Examiners at the Home Office are abnormal

intrusions. We do not discourage this for out of these risks which have been rejected by other companies we sometimes find good insurance. Certainly the mortality ratio of 47.15% obtained in New York City in recent years is good evidence of first-class selection.

The following table shows the individual years of the recent period:

TABLE VIII

Year of Issue	(1) Value of x	(2) Theoretical Value of y	(3) Actual Value of y	(4) Exposures	(5) Actual Deaths	(6) Expected Deaths	(7) Ratio
1907	4.53	2.8233	3.317	14,772	49	67.846	72.3
1908	5.05	2.6072	3.064	28,385	87	133.995	64.9
1909	4.74	2.7326	2.623	34,734	91	158.158	57.5
1910	4.99	2.6307	2.540	37,378	95	169.911	55.9
1911	4.87	2.6788	3.098	42,632	132	191.042	69.1
1912	4.92	2.6586	2.616	49,342	129	220.441	58.5
1913	5.04	2.6111	2.433	51,370	125	226.160	55.3
1914	5.23	2.5391	2.293	48,357	111	212.984	52.1
1915	5.21	2.5465	2.182	50,438	110	225.274	48.8
1916	5.03	2.6150	2.781	58,570	163	266.116	61.3
Total	5.00	2.6268	2.625	415,978	1092	1871.927	58.3

Considering the limited number of deaths in each year the actual results approximate the theoretical results closely. In 1907 and 1908 conditions were still somewhat abnormal following the insurance investigation. In 1914 and 1915 our mortality was a little lower than the theoretical value of y, but these years were also a little abnormal on account of the European War and the consequent diminution in business.

The following table shows the results for the individual years of the older period:

TABLE IX

Year of Issue	(1) Value of x	(2) Theoretical Value of y	(3) Actual Value of y	(4) Exposures	(5) Actual Deaths	(6) Expected Deaths	(7) Ratio
1893	2.71	4.546	4.282	34,083	146	153.591	95.0
1894	3.30	4.211	3.979	36,697	146	165.100	88.5
1895	3.03	4.361	4.160	36,279	151	165.889	91.1
1896	2.84	4.470	4.839	34,126	165	157,558	104.8
1897	2.93	4.418	4.492	37,363	168	170,408	98.6
1898	2.84	4.470	4.952	28,265	140	132.398	105.7
1899	2.83	4.476	4.946	46,924	232	215,404	107.9
1900	2.99	4.384	4.529	52,082	236	235,220	100.5
1901	3.13	4.305	4.415	61,375	271	273.265	99.2
1902	3.22	4.255	3.781	68,541	259	297,192	87.0
1903	3.30	4.211	4.287	74,375	319	317.467	100.5
1904	3.58	4.059	3.953	82,729	327	353.730	92.2
Total	3.13	4.305	4.316	592,839	2560	2637.222	97.1

In this table the force of selection, a, = 1.78 instead of 1.97 as in tables 7 and 8. It was there explained that the selection in the earlier period was less careful than in the recent period. This is shown in a general way by the fact that in the earlier period the total disapprovals amounted to 10.34% of the applications while in the later period these amounted to 14.41% of the applications.

I trust that with these explanations the fit of the theoretical equation to the actual figures will be granted. I would like to continue the research into the second and subsequent years, but our President has just said that the manuscript must be handed in now, in order to be printed for this meeting. If anyone can find a better equation or make a closer fit, he will be heartily welcomed.

Let us summarize our conclusions:

(1) There is a distinct correlation between the percentage of risks "Disapproved by Medical Examiners" and the mortality for the first and subsequent policy years.

(2) This correlation is negative and therefore the mortality

becomes smaller as the percentage of "Disapproved by Medical Examiner" becomes larger.

(3) The correlation decreases with the duration of insurance but shows some evidence even up to the tenth policy year.

(4) The correlation is not perfect even for the first policy year, for the Medical Examiner is only one of many factors in selection. Furthermore, he cannot be held responsible for a certain proportion of those deaths which are due to external causes and acute diseases.

(5) In order to express the correlation in a general manner, Mr. John S. Thompson has suggested the following equation:

$$y - u = (x^2 + k)\, a^{-x}$$

For definitions see page 46.

Dr. Symonds—We are very grateful to Mr. Henderson for his review of my paper and personally I wish to thank him for his criticism. With the unerring instinct of the skilled mathematician, he put his finger on the one weak spot in the mathematical framework. Naturally I sought corroboration for his opinion that the correlation for the first policy year in the early period is spurious. Mr. Thompson kindly worked out by a second degree equation this correlation which showed a correlation coefficient of $-.185 \pm .187$. I then had it worked out by means of a new set of ordinates drawn against a graphic curve and the correlation coefficient by this method was $-.057 \pm .194$. Both these coefficients corroborate Mr. Henderson's opinion that the correlation for the first policy year in the early period is spurious. I am glad that he went on to demonstrate that for policy years 1–5 together in that early period the correlation was excellent and not spurious but I am sorry that he stopped there. The correlation for the first policy year in the recent period is first class when subjected to the same treatment. Mr. Thompson fitted that to an equation of the second degree and Mr. Bliss fitted it to an equation of the third degree with the results as shown in the following table:

Year	SECOND DEGREE GRADUATION		THIRD DEGREE GRADUATION	
	(x) Disapproved by Medical Exam.	(y) First Year Mortality	± (x) Disapproved by Medical Exam.	(y) First Year Mortality
1907	4.53	72.28	4.53	72.28
1908	4.72	66.86	4.81	65.28
1909	4.87	62.41	4.97	61.25
1910	4.99	58.94	5.02	58.05
1911	5.07	56.44	5.02	57.45
1912	5.12	54.92	4.98	57.30
1913	5.14	54.37	4.96	57.40
1914	5.12	54.79	4.97	57.17
1915	5.07	56.19	5.06	56.04
1916	4.98	58.56	5.26	53.43
Mean	4.96 ± .0419	59.58 ± 1.201	4.96 ± .037	59.57 ± 1.107
Standard Deviation	.19 ± .02	5.63 ± .849	.173 ± .026	5.191 ± .783
Coefficient of Correlation	−.997 ± .001		−.979 ± .009	

The correlations given above are so nearly perfect that they are almost too good. It really seems, however, as though the first year mortality and the "Disapproved by the Medical Examiner" bend together in inverse harmony in this recent period. Furthermore Mr. Bliss submitted the policy years 6–10 together in the early period to a second degree equation and determined the coefficient of correlation to be $-.495 \pm .161$. This is even better than the previous results on a rectilinear basis, for the coefficient is more than three times the probable error. Altogether there is a definite correlation in the early period between the "Disapproved by Medical Examiner" and the subsequent mortality. The correlation for the first policy year in the early period is undoubtedly spurious, as Mr. Henderson has shown. It seems reasonable to suppose that this may be due to paucity of data on both sides in the early period and that when the data have accumulated enough to correct this, the correlation becomes evident and reliable, as Mr. Henderson has demonstrated for the policy years 1–5 taken together.

I think that after this extensive analysis no further question can be raised as to the fact of a substantial inverse correlation between the "Disapproved by Medical Examiner" and the mortality of the first and subsequent years. Mr. Henderson raises the point whether this correlation signifies cause and effect, and shows that an increase of the disapproved of 0.1% would increase the mortality to 2147% of the expected. This sounds terrific but he overlooks the fact that these risks are not border-line cases as he assumes. On the contrary they are physically and organically defective, and have been rejected by the Medical Examiner outright before the papers leave his hands, and his view is finally endorsed by the Medical Department. Let us apply Mr. Henderson's reasoning in detail. For the year 1916 there were 85,217 applications and 0.1% of these amounts to 85. The exposures were 58,737, the actual deaths were 157, and the death rate was 2.67 per 1,000. As this is in the recent period, which has been proved to have an excellent correlation, the regression of $y = -27x$. As the mean of the disapproved for this period is 4.96, a percentage of 5 among the disapproved corresponds to 58.50% mortality and a percentage of 5.1 correspond to 55.80% mortality. Then this additional one tenth per cent. ought to show a mortality of 26.21% of the expected according to Mr. Henderson. Now the expected deaths in that year were 4.5 per thousand by the Medico-Actuarial Table. We, therefore, multiply together $.085 \times 4.5 \times 26.21 = 10.02$. Out of the eighty-five rejected applicants therefore 10.02 are supposed to have died during the year following their rejection. Does that seem an excessive number out of 85 persons who were actually rejected by a medical examiner at the beginning of the year for physical defects such as pulmonary tuberculosis, heart disease, high blood pressure, diabetes, etc.? These are not border-line cases nor is it necessary to assume that any of them are fraudulent. Some of them might be semi-fraudulent in the sense that an applicant might have suppressed some of his previous history and only very skillful physical examination brought the real facts to light. Altogether they are bad

risks, whom a medical examiner has rejected outright for good reason.

Mr. Henderson also criticizes Mr. Thompson's equation on the ground that the first one per cent. of disapproved would show a mortality of 297. per thousand. From table 4, one per cent. of the exposures is 4159 and on this basis 1235.22 out of that number should die in the following year. This seems a very reasonable number when we reflect that this first one per cent. of rejected would be composed of these who were unmistakably ill. The following table shows the deaths that actually occurred in the Registration Area of the United States in the year 1911 from certain causes, the age-distribution being that of the entrants in the Mutual Life Insurance Company as set forth in Table 4.

Ages	Exposures Mutual Life 1907–1916,	EXPECTED DEATHS FROM					Total Deaths
		Tuberculosis	Apoplexy	Cancer	Heart Disease	Bright's Disease	
15–19	30,431	35.09	.65	.74	7.27	3.26	47.00
20–24	78,341	147.28	2.66	3.28	20.06	12.93	186.21
25–34	150,476	327.74	12.43	21.10	62.44	48.60	472.31
35–44	100,311	229.11	29.89	58.79	90.98	74.93	483.70
45–70	56,418	109.39	93.89	122.27	160.40	126.88	612.83
Total	415,977	848.61	139.53	206.17	341.15	266.60	1,802.05

These five causes above account for one and a half times the deaths required by Mr. Henderson. In fact tuberculosis and heart disease show 1189.76 deaths, nearly as many as the required deaths. He then goes on to say that the tenth one per cent. of those rejected—the term is a little awkward but understandable—would show nearly double the mortality expected by the M. A. Table. Again it must be emphasized that these rejected cases are bad risks, so bad that a medical examiner has actually disapproved them. Undoubtedly the defects of the tenth one per cent. would be found only by a very

skillful examiner but that would not diminish their importance or significance.

Dr. Dwight takes a small clause out of one sentence and then preaches quite a sermon on that. It reminds one a little of the atheist who endeavored to establish his disbelief by quoting the latter clause of the first verse of the 14th Psalm but was finally subdued by his opponent who quoted the opening clause. Dr. Dwight then imagines that the low mortalities are due to overselection, as he calls it, but let me assure him that these mortalities represent the entire business of the Mutual Life in the United States and Canada for each of the years mentioned measured according to the mortality table and methods used in the Medico-Actuarial Investigation, except in the few cases where certain agencies are mentioned, some of which are bad and others good.

It is not at all surprising that companies which issue substandard policies do not place much confidence in the medical examiner's opinion on the insurability of a risk. I quite agree with Dr. Rockwell's views and the reasons therefore. We have found that by training all our medical referees, who number 63, at the Home Office, they are able to pass some of their acquired knowledge to the field examiner by correspondence, personal interviews, etc. The method seems to have succeeded very well if we may judge by the results in the last fifteen years on our mortality.

Without Mr. Thompson's help the latter part of my paper would be non-existent for it depends upon the equation which he suggested. In regard to this he wishes me to say:

"The average mortality rate of 8.5 per 1,000 was derived by applying the rates of mortality according to the United States Life Tables, 1910, to the 'Exposed to Risk,' as explained in the paper. It is, therefore, the mortality in a large sub-group of the general population distributed as to age in the same manner as the insurance in question. It was assumed that in a random selection from the population, the United States Life Table, 1910, q x would be experienced; the formula was devised to measure the effect of different degrees of selection

as applied to such a group. The selection experienced by an insurance company of course differs from that dealt with here inasmuch as it is applied to the group *applying for insurance.* Under the selection exercised by Industrial companies, the resulting mortality is considerably higher than that among the general population as is evidenced by the high rates shown in the Standard Industrial Table.

"There is no doubt that Mr. Henderson's formula is a much more general statement of the case."

While further study may modify the mathematical value of the correlation and the equation, it seems to be established that:

1—There is an inverse correlation between those risks which are disapproved by the medical examiner and the mortality. As the one increases the other diminishes, within a certain range, and a duration probably of ten years.

2—This correlation is causal, though perhaps not to the full extent indicated by the coefficients.

3—There is great value to the Company in educating its medical examiners, for the greater their skill and knowledge in insurance selection, the better is the protection to the Company.

DISCUSSION

Mr. Henderson—The subject of Dr. Symonds's paper is one of very great importance to all of us and I am very glad to have had an opportunity to study it and to hear the discussion. While the remarks which I shall present are largely confined to the mathematical, or rather statistical, aspects of the paper, those aspects cannot be satisfactorily treated without some consideration of the subject matter which is subjected to analysis. Under these conditions I wish, in advance, to crave your indulgence where it may be necessary to touch upon the medical aspects of the question.

In the first place it may be well to point out that while a significant correlation may in general be considered as evidence

of a causal relation between the two variables, that relation is not necessarily one of cause and effect, but may be one of common cause. If, however, the relation between the two variables is not direct, their mutual correlation is less than that of either with the common cause connecting them. It is in fact theoretically the product of the two so that, for example, if they have correlations .8 and .9 respectively with the common cause their mutual correlation would be .72. If therefore we reject the hypothesis of a relation of cause and effect, we substitute that of a still higher degree of correlation of each with some possible common cause. Where, however, the first hypothesis leads to results in conflict with known facts or is otherwise inadmissible we may be forced to reject it as a complete explanation of the facts and resort to the second as at least a partial explanation.

The results arrived at in the investigation of the correlation between the disapprovals by the medical examiners, in the sense of adverse recommendations concurred in by the Medical Directors, in successive calendar years and the rates of mortality among the accepted lives are somewhat startling, not so much in nature as in degree.

An examination of the data and graphs suggested that the apparent correlation might be to a large extent spurious and due to the concurrent secular changes occurring in the two elements. The figures for the issues of the years 1893 to 1904 inclusive were accordingly submitted to a closer analysis. Second degree curves were fitted to the percentages of disapproval and to the first year mortality percentages and the correlation between the departures from the graduated values investigated. This modification reduced the standard deviation of the disapprovals to .146 instead of .243 and that of the mortality percentages to 5.167 instead of 6.511, and the correlation coefficient came out $-.140$ instead of $-.563$. As this coefficient was numerically but little in excess of the probable error, it seemed at this stage as if the surmise had been verified. A similar process was, however, applied to the mortality percentages for the first five years combined and in this case

the standard deviation of the mortality percentages came out 4.446 instead of 6.002 and the coefficient of correlation −.701 instead of −.853, thus showing in this case a quite significant degree of correlation about thirteen times the probable error. In fact if we worked out the equation of regression of the mortality on the disapprovals it comes out for the revised figures $y = -21.3\ x$ as against $y = -21.1\ x$ from Dr. Symonds's figures showing an almost uncanny agreement. For the first year mortality percentages the revised equation is $y = -5.0\ x$ instead of $y = -15.1\ x$ showing in that case a very substantial reduction.

On the whole, therefore, we must conclude that the correlations brought out in the paper are to be considered as significant. Before concluding, however, that they mean a relation of cause and effect to the extent indicated, let us investigate some of the consequences which would follow from that hypothesis.

The average percentage of disapproved by examiner was 3.06 and the average mortality percentage 101.01 for the first five years. Assuming then Dr. Symonds's coefficient −21.1 as representing the regression we see that to 3% of disapprovals would correspond a mortality of 102.28% of the expected and to 3.1% would correspond a mortality of 100.17% of the expected. If, however, the inclusion of an additional one tenth of one per cent. among those approved increases the average mortality from 100.17% to 102.28% it follows that the mortality of that one tenth of one per cent. must be approximately 2147% of the expected. It seems impossible to believe that this represents the mortality to be expected among those border-line cases which are sometimes approved and sometimes disapproved when it is remembered that there are whole classes of risks considered worse than those border-line cases and unquestioningly disapproved for standard insurance which nevertheless when insured on the substandard plan present an actual mortality less than 200% of the expected.

Applying a similar analysis to the graduated series exhibited in Table 6, it would appear that the death rate per thousand to

the expected the first year amongst the first one per cent. disapproved would be 297.0 per thousand, among the second one per cent. 124.6 per thousand, among the fifth per cent. 45.5 per thousand and among the tenth per cent. 8.7 per thousand or nearly double the expected mortality by the M. A. Table.

The facts brought out in the paper appear, therefore, to establish a higher degree of correlation than can be accounted by a simple and direct relation of cause and effect, unless possibly the fluctuations in the percentages of disapprovals represent fluctuations in efficiency in detecting and eliminating fraudulent cases. In order to see if it might be due to some cause outside of the company and applying to all companies alike, I worked out the correlation between the first year mortality percentages of the Mutual Life as given by Dr. Symonds and those of the Metropolitan Life as given by Mr. J. D. Craig on page 253 of the May, 1920, number of the Transactions of the Actuarial Society. For the eight-year period 1897 to 1904 inclusive, the correlation came out .282 and for the ten-year period 1907 to 1916 it came out .260. It would thus appear that we are not likely to find a cause outside the company sufficient to account for the facts brought out.

With regard to the formula used to express the connection between mortality and disapprovals it appears to be in form well suited to the purpose. There are only a few slight criticisms which may be offered. The first relates to its use. I would not have attempted to bring under a single law, figures representing the experience of different agencies over the same period and those representing the experience of all agencies combined analyzed by year of issue. The causes operating would appear to be substantially different in the two cases. With regard to the form of the equation itself a more general form such as $(k + lx + mx^2)\, a^{-x}$ would appear desirable. Possibly this was tried out and it was found possible to simplify it by putting zero for l and unity for m. It does not seem necessary, however, that when x becomes equal to zero the equation should give a rate of mortality equal to that expected

according to the general population table. The mere fact that a selection is known to be made will prevent many of the worst lives from applying at all so that a lower rate of mortality would appear to be admissible as the limiting value.

Mr. Thompson—It was with considerable hesitation that I undertook to make any remarks before this Association, but the subject matter of this paper was so inviting that no actuary could reasonably decline, and my remarks will be confined to those of a general nature. In the past it has, I think, been too often felt that Medical Directors and Actuaries spoke different languages. Now, on the contrary, we are increasingly conscious that the special phases of knowledge of the doctor and of the actuary are complementary rather than exclusive, and it is not uncommon for the actuary to write in an unostentatious way of medical impairments, though perhaps in terms less vivid than that which is at the command of the physician, and for the doctor to apply to his problems the most advanced statistical treatment. By a curious coincidence, Mr. Arthur Hunter, Chief Actuary of the New York Life, will read next week at the meeting of the Actuarial Society of America, a note with a medical flavor on "Is the 'Average' the Same as the 'Normal' for Weight and Blood Pressure?" and to-day we are giving thought to Dr. Symonds's analyses of the statistical relations between first-year mortality and the medical examiner's action. With reference to this latter paper now before us there is no doubt that some future readers of the Proceedings of the Medical Directors' Association will pause and glance surreptitiously at the title of their volume in order to assure themselves that they have not strayed into the Journal of the Royal Statistical Society or a number of Biometrika.

A moderately careful reading of this scholarly paper will not fail to reveal that my contribution to the development of this subject is distinctly nominal. The curve which Dr. Symonds has used merely appeared to be one possessing in general the character necessary for the purpose in hand; and credit for the testing and fitting is, of course, his. Unfortunately it is not safe to assume that the designated relation exists beyond the

limits of observation, although it must be admitted that over the very considerable range of the experience, the constants have been determined in such a manner that the adherence of the theoretical curve to the actual facts is quite satisfactory. It was intentionally assumed that as x approached zero, y would approach the general mortality among the population. It is true that the knowledge of the existence of selection will defer the worse lives from applying, but, on the other hand, many of the best lives are indifferent and the actual result is, of course, problematical.

It must be remembered that variables may be uncorrelated, but by no means independent. The coefficient of correlation like an average or a measure of dispersion only crystallizes into easily comprehensible form one very particular phase of the facts on which it is based and the real difficulty arises in the interpretation of the coefficient when obtained or rather in the consideration of it in relation to other circumstances. First-year mortality or the general mortality is complex and the product of many influences, both immediate and remote. In addition to there being the censorship of the company in the person of the medical examiner, which is probably the most positive influence, the mortality of a company may be said to be governed by (1) the mortality of the general population, (2) the character of the sampling which is performed by the agent, (3) the nature of the circumstances which affect the character of the lives presented exclusive of the selection made by the agent; these latter influences would be largely economic and those conditions which affect the proportion of clients which the agent is able to bring to the point of being examined will vary greatly from time to time; it is, therefore, not unreasonable to suppose that there may be correlation between first-year mortality and the proportion of lives interviewed by the canvasser to which he is ultimately able to sell policies. Furthermore, the dependence may extend to the state of trade or even to weather conditions not to mention others which are still less capable of measurement. And the mere quantity of business submitted may have a very direct

bearing. In any case, the value of a coefficient may be consistent with a certain hypothesis, but on the other hand it may be equally consistent with others and there is required not only care and judgment for the deduction of conclusions and for the discussion of possible theories, but also thorough knowledge of the facts in all other possible aspects.

It is distinctly valuable to have the relation between the medical examiner's opinion and the resulting mortality reduced to concrete form. Whatever may be the many-sided significance of this remarkable correlation, it is certain that any radical change, intentional or otherwise, in the functioning of the selection—machine, would in time be reflected in the size and sign of the correlation—coefficient. Its relative value, then, is considerable.

There is no doubt, from the analyses presented, that what is virtually being measured is the consistency of treatment of border-line risks. At one epoch in a company's history the "declined by examiner" is small and the rate of mortality high; after a change in the company's policy regarding acceptances, a larger percentage is declined and the mortality becomes more favorable. Since the great proportion of lives applying for insurance are either readily acceptable or clearly unacceptable, the difference must arise from more strict treatment of those minor impairments which enter largely into the constitution of those so-called "doubtful" cases; in the present investigation results indicate that the "tightening-up" process, that of raising the company's standard, has been fairly successfully carried out. Mr. Henderson has pointed out that on the basis of the relation derived in the paper the difference between the mortality in the first five years when 3% is declined and that which results when 3.1% is declined is such that the mortality implied among the additional 0.1% is over twenty times the expected. This is large and whilst it is not impossible, it is evident that the relation between the two variables is not as direct as the linear equation of regression would indicate or possibly that the additional admissions are not all so-called border-line cases.

It may be pointed out that the question: "Do you without reservation recommend the applicant for insurance?" has no particular significance in case of the company which writes substandard business. It contemplates only the issuance of one class of insurance, the level of which standard is in a general manner comprehended by the examining physician.

Incidentally, the author has painted the way to an absolute means of measuring the efficiency and judgment of an examiner, and therefore of comparing the individual results attained by a group of examiners. In the paper, comparison is made between what is designated the "force of selection" for two different periods, with all the attendant differences which that involves. In the same manner it would be possible to compare the selective powers of two examiners at the same or different times, in the same or in different localities, due attention being given to the fixing of appropriate constants depending on the lives examined in each case. The advantage is that the measure would be, in a sense, absolute and to some extent removed from the effect of varying conditions. In a similar way, the action of the same examiner could be tested from time to time, and its uniformity of adherence to standard examined with a view to determining whether the examiner is, with the passing of time, taking a varying attitude toward the risks presented to him. A serious requirement for such investigation would be the existence of a sufficiently large body of experience in each case.

In conclusion, I think I may safely say that both the Medical Directors Association and the Actuarial Society are indebted to Dr. Symonds for blazing the trail to a new point from which to view the question of selection.

Dr. Dwight—Mr. President and Gentlemen,—An invitation to discuss one of Dr. Symonds's papers is always a compliment, but an invitation to discuss this paper was rather stunning. Fortunately, Dr. Symonds made it easier yesterday by explaining that I was asked to discuss the paper because he thought I represented one of those companies which had a

great deal of confidence in the opinions of the medical examiner.

In looking over Dr. Symonds's paper, I cannot but feel that the New England Mutual has a great deal less confidence than has the Mutual Life. We never have believed that our medical examiners were capable of doing our work, and one of the very essential parts of our work is to decide what points are important, and what are unimportant.

I see here the statement, "He knows what impairments have practically no influence on mortality, such as flat feet, cardio-respiratory murmurs, etc., and does not cumber his report with details of inconsequential trifles."

One of the medical men in Boston, whom I have known for a great many years and who has examined for the Mutual Life for a number of years, told me that he "did not report heart murmurs unless he thought they were important; that he did not report albumin unless he thought it was important." To my mind the company that considers these "inconsequential trifles" has much more confidence in the judgment of the medical examiner than we have.

Of course, we are not particularly interested in flat feet, and there are other things in which we are not interested, but we do not consider that our medical examiners are capable of passing on purely Life Insurance medical questions. We require that our men shall give us the facts and let us decide as to their importance.

Another point, which I think I understand from the paper, is that these statistics are based upon accepted risks, not upon declined risks, and that the statistics, which we have here, represent not the opinion of the medical examiner, but the relative value of the opinion of the Home Office and that of the Medical Examiner. That is, these are cases which are not recommended by the medical examiner, but were accepted by the Home Office notwithstanding that fact.

I think that most of us would be ready to accept the theory that our judgment was better, on our own subjects, than the opinion of the medical examiner in the field, and I am not sur-

prised at Dr. Symonds's results. I will not try, even if I am capable of doing it, to go into the methods of obtaining these results, because it seems to me that we have here another application of the same fact which we are constantly running across in all of our medical investigations; that is, that an extremely careful medical selection is capable, to a very large extent, of controlling the mortality which we would naturally obtain from a group where the general, or average, mortality is very high.

I assume that Dr. Symonds would agree with me that, if the Mutual Life had accepted all of the cases which had been advised against by the Medical Examiners and had taken them without any selection from the Home Office, his mortalities would have been very different. He has accepted comparatively few of those cases which were advised against by his medical examiners, which means that Dr. Symonds has applied to a large and important group almost an overselection. These cases have been gone over with great care, and they have been taken when he knew that it was contrary to the advice of the men in the field, in whom he had a certain amount of confidence or he would not have appointed them, so that this is, to a very great extent, an overselected class. I do not like the term because it was not an unnecessary overselection. The term, overselection, naturally carries with it the idea of an unnecessary selection. This was a necessary selection; a very careful and accurate selection; a selection made necessary by the fact that he was considering a group the mortality of which would be very high if it were not carefully selected. As a matter of fact he says, "Even if a risk is occasionally accepted in spite of it." That is, as I understand it, in spite of the answer to the final question.

Now the value of the opinion of the medical examiner will depend very much on what he is expressing an opinion. If he is expressing an opinion on the sounds which he hears and their interpretation, that value will not only depend entirely, or almost entirely, on the amount of his knowledge, his experience, his ability, but also to a very large extent upon the

knowledge which the Home Office has of him. The value of the opinion of a medical examiner is worth almost nothing, unless we know enough about him to give us confidence in his opinion as it is expressed. If he is expressing an opinion on the insurance side, as to whether a man with flat feet is a safe risk for insurance, or whether a man with a cardio-respiratory murmur is acceptable, it may be of some value. If, however, he is expressing an opinion as to the insurability of healed Syphilis, I doubt if it has any value, not because he is lacking in the ability which we have, but because he is lacking in the opportunity to obtain the information which we have. We do not consider that the opinion of the ablest men of the country, as to the insurance hazard in a man who has had his gall bladder removed, is of any importance whatsoever. He does not know, that is all. Very few of us do, by the way, but we have a few facts in regard to it, and our judgment for our own company should be accepted without question, as compared with the opinion of any man outside.

I am not going to take up the time of the Association further. This is a wonderful piece of work. I wish to call your attention to the fact that Dr. Symonds's results are not surprising, due to the fact that they represent, not a large class, but an extremely carefully selected class, overselected if you will, although I do not like the term, and that the value of these opinions depends upon the questions upon which the opinions are expressed, and upon your knowledge of the man, his ability, and your confidence in his work.

Dr. Rockwell—In his usual masterly way, Dr. Symonds has again presented a most valuable contribution to the records of this Association. It is particularly pleasing that he has used his Actuarial knowledge in analyzing a Medical problem of great importance to us all. The Actuarial part of his paper has been ably discussed by those competent to do so; hence, I shall confine my few remarks to the usages of my own Company, and our experience with and without a direct expression from the examiner as to the insurability of the risk.

Until about three years ago we asked the examiner whether he considered the applicant to be first-class, fair only, doubtful, or bad. For a long time it seemed that the greater number of cases we subsequently declined were recommended, more or less favorably, by the examiner. This was particularly true in reports coming from the smaller cities, or from the country. Even though the examiner reported an abnormality and expected the risk would ultimately be declined, his recommendation was likely to be that the risk was first class; so that when the local agent or the applicant learned of our adverse decision, the doctor could "straddle" the situation very nicely by expressing surprise, and saying that *he* had recommended the risk, but no doubt the people at the Home Office objected to the slight impairment it was necessary to record.

The Equitable has what we are pleased to call "Medical Referees" residing in several of the larger cities. These men have been carefully trained at the Home Office and have knowledge of the way in which we desire a report to be filled out and information presented. In cases examined by them personally, or by our Home Office staff, their opinion may be of importance to us.

More than twenty years ago, we began to write sub-standard business. Those of you who have had actual experience with this class of business will appreciate that changes in the ratings may be necessary from time to time as one's experience grows; so we find the Examiner, or even the Medical Referee, is not always able to forecast just what final disposition may be made of the application before him. We noticed that while the doctor might not recommend the case as first class, or even fair, he perhaps would say, "Good for sub-standard," which in his opinion, might cover a "multitude of sins."

We were finally led to the conclusion that, after all, what we desired most were the exact facts as to the conditions discovered by the examiner reported to us in a careful and definite way. To this end we designed quite a good many circular letters, covering such points as lungs, heart murmurs, urine, habits, general appearance, blood pressure, etc. A supply of

these letters, or supplemental reports is in the hands of our Medical Referees and principal examiners, so that when an abnormality is discovered, the doctor can fill in accurately the appropriate blank and forward it with his examination. In smaller cities, and in the country, we send requests for this additional information from the Home Office, on receipt of the papers there. In addition to this, we issue circulars, on one subject or another, to our examiners two or three times a year. This serves to keep them in close touch with the Home Office.

It is our custom to send a Medical Director to outlying points several times a year, especially to places from which we are getting a considerable amount of business, in order to meet our doctors personally, and we try at the time of our visit to indicate to them the way in which we like to have our examinations made. I believe that 80% of our applicants are examined by physicians personally known to us.

Then, too, we have several Traveling Medical Inspectors, who go through a state at a time, removing undesirable examiners, appointing new ones, and giving the latter instruction as to our rules and methods concerning the making of examinations.

Our Medical Blank has been gone over time and again and we feel, with all due modesty, that the one in use at the present time is quite efficient and serves both legal and medical purposes very well. For several years we have been selecting our risks by numerical ratings, so that if all the facts are given to us by an examiner, we are not, at present, as deeply concerned regarding his personal opinion of the risk as we were formerly. And, moreover, it is our belief that the examiners are very glad to be relieved of the necessity of placing their opinion on the papers. If the applicant or agent talks it over with him later, the doctor can state, "Why, I put down only the conditions revealed by my examination and left the ultimate action to those at the Home Office." In view of the many checks we have, and our apparent ability to arrive at the true facts satisfactorily, we are, so far, very well pleased with the change we have made. Furthermore, if the doctor really feels that he

wants to report something additional, there is a space on the blank which he is permitted to use. As a matter of fact, it seems to us that we get more information, and with much less delay, than when it was his custom to forward a confidential letter relating some adverse feature, which he hesitated to explain fully in the examination.

Dr. Toulmin—Mr. President and Gentlemen: We all appreciate this splendid paper which, like all of Dr. Symonds's contributions, is thorough and profound. I shall discuss only two of the phases of the question.

As to the disposition of the completed medical examination I think we will have a larger or a smaller percentage of cases not recommended by the examiner, other things being equal, as we do or do not allow agents to handle the completed examinations. I wish to ask all of those who believe it is best to have the examination paper as completed by the examiner sent direct to the Home Office and not go to the agent, to stand. I am going to ask those to stand who allow their papers to be handled through the soliciting agent. (Standing vote taken.) It is evident that the majority favor the former method.

The other phase of the question is that referred to by Dr. Rockwell as to instructing our examiners with the desires and wishes and rulings of the Medical Department. If the examiner in the field knows something about the selection of risks he will often not recommend an applicant, whereas an examiner with only general medical knowledge—in other words, the average examiner—will recommend the same risk, with or without, qualifications.

The practical point that I wish to bring out is, "What is the best way to teach examiners the viewpoint of the Home Office?"

In our Company we send leaflets to our examiners from time to time; for instance, a leaflet on the technique of blood pressure; another on the technique of the analysis of the urine; another on overweight and underweight, etc. These are always sent with our book of instructions to our newly appointed

examiners (such books, as we all know, often find their way into the waste-paper basket before they are read and digested). Then from time to time every active examiner gets these leaflets with his pay check. I think we have accomplished good results. We have other leaflets to which I have not referred. They are all thoroughly practical, simple, and as short as we can make them. It is our hope that they will be read even by the busy country practitioner.

Usually too, when we find that an examiner is lacking in his method of taking blood pressure, or of urine examination, or careless in his family history record, we lay additional stress on the importance of proper technique and full details in a letter which accompanies the leaflets.

Dr. J. Allen Patton—The value to be given the field or local Medical Examiner's opinion of cases that he is called upon to examine has always been a debatable question in the minds of the executive management of life insurance companies.

Life insurance was conducted without medical examinations in its earliest years and some companies at the present time are considering a return to that practice to a greater or less extent.

Medical examinations and Medical Examiners' opinions have been found valuable and always will be for certain classes of applicants and certain kinds of policies.

Group Insurance differs from a broadcast insurance of everyone without medical examinations, for it is applied to selected bodies of persons united under a common bond of employment and usually written where some selection has been made based upon the physical fitness of the employees for the occupation in which they are engaged.

Medical Examiners record the applicant's personal and family health history, the applicant's physique and the results of a physical examination in accordance with the blank of the company for which the examination is being made.

Every Home Office reviewer of medical reports recognizes that there is a difference in his dependence upon the statements

made by the different field examiners with whose work he has become familiar. Necessarily the view and opinion of the field and Home Office medical man must frequently differ regarding the insurability of an applicant, as the latter has to take a more comprehensive view of the case. A life insurance examiner's experience teaches him that while physical defects must be noted and described, yet text-book and pure physical standards are rarely found and that they must be compensated for by practical every day conditions that enable an individual to live normally and continue to follow a regular occupation.

The field Examiner's rating of his cases as "First-class," "Average," or "Poor" will depend upon his personal opinions as modified by the results of his examinations and whatever instructions he has received from the Home Office of his company.

We have made no calculation of our Home Office action on cases rated "Poor" by our Examiners, but it is our cardinal rule not to take action for or against any case rated "Poor" unless the Examiner has fully stated his reasons for such a rating. Further investigation of cases of this type has rarely brought about favorable rating and action in those received from experienced Examiners, but, on the other hand, the receipt of more complete or supplemental reports from experienced Examiners has enabled us to clear up and approve some applicants that would have been declined upon the reports of new or inexperienced Examiners.

Studies of the mortality experience, based upon the Examiners' reports, should be carried out more definitely than is the general practice, and it is believed that this would be of enough value to warrant the incidental time and expense. The calculations made by Dr. Symonds would require more time and study than I have been able to give them since the copy of his paper came into my possession; hence I am not in a position to make any appropriate comments upon them.

A study of the results of trained Examiners with the experience of the Referees of the Mutual Life could hardly be compared with that of the average field Examiner, but the work of

both classes of Examiners should be followed to enable the Home Office to judge more accurately and definitely the value of an Examiner's services. Such studies, as this of Dr. Symonds, show us that there are many fields in our own branch of the business that we could follow with advantage to our companies and to ourselves.

Dr. Weisse—I think we have all appreciated Dr. Symonds's paper very much. It is on a par with the ones which he has presented before, and very valuable both from a medical and an actuarial standpoint. We thank Dr. Symonds very much for his contribution.

Dr. Willard's paper on "The Need of General Education in the Matter of Public Health," is a very timely one. As I have already said, I feel that the time has come when this Association must step out and take a stand with the associations that are doing their best to educate the public along hygienic and sanitary lines, and to assist them, if necessary in legislative matters.

ON THE NEED OF GENERAL EDUCATION IN THE MATTER OF PUBLIC HEALTH

By Thomas H. Willard, M.D.

Medical Director, Metropolitan Life Insurance Company

The History of Human Error has many times been written, but with the passing of time there is always the need for a new edition to bring the subject thoroughly up to date.

In the many books that have been published there have not been any references to life insurance, as such, though many are the allusions to methods of prolonging life, curing disease, foretelling the future, and gaining Heaven by means widely

various, extending from the ignorant superstitions of the untutored savage down to the mass of present-day fads, harebrained systems of thought, and illogical assumptions which form the bases of elaborate cults bewildering the thoughtless and retarding to some extent the march of intelligence.

We can remember when the "Blue Glass" craze surged over the country and engaged the attention of the mind of the public which now seems to be occupied unwisely with the study of "ouija" boards and spiritualistic manifestations.

It is not proposed to enumerate all these aberrations nor to supply the missing chapter in the list of credulities which have marred the progress of humanity but to tell of some of the suggestions and offers of aid in selection which the medical department of a life-insurance company receives from thoroughly unqualified laymen, many of them sincere though ignorant, more with itching palms and a desire to benefit humanity for a definite fee per head, many fools and some whose sanity might well be questioned.

Doubtless other companies receive similar communications but it would seem that the company I have the honor to serve has been favored more than the others represented in this Organization because for so many years it has been prominently identified with welfare work among its policy holders, field and Home Office force, and the general public, and of this curious collection which has drifted into our office in the last thirty years we will make a few selections—many would be amusing if they were not almost pathetic.

Over twenty years ago we received from a very great astrologer, who, however, modestly claimed only the simple title of professor, and be it said resided in Hoboken, New Jersey, the offer to cast the horoscope of every applicant for insurance. He pointed out to us the ease with which our selection could be made, how we could secure a phenomenal mortality experience by refusing to accept those who would not live out their expectation of life. The fees he asked for this service would have given him nearly two million dollars a year.

Consumption and cancer are the subjects discussed in the majority of cases and doubtless many of our correspondents did succeed in deluding some poor unfortunates. Some of the specifics were represented as having been handed down through several generations in the family of our correspondents while others were the unaided inventions of men engaged in the perfectly respectable occupations of bookkeepers, painters, and fire-insurance agents.

A short time after our Sanatorium at Mount McGregor had been inaugurated, we received an offer from an individual who was "shure" he could effect more cures than any man living. He signed himself as, "Professor of the True Method of Healing the Sick."

Another example is interesting because it claims to explain the manner by which the desired result is accomplished. A woman who described herself as a small wage earner and aged 74, sent us an eight-page letter to set forth a formula for the cure of consumption as follows: "Prevention and Cure. New Life for Consumptives and Others. Egg nog de Luxe. Pure Food Tonic. Formula: Dose for Adults. Beat up well the yolk of a new laid egg in three large tablespoonfuls of Rose water, one teaspoonful of Orange flower water, one tablespoonful of honey and one tablespoonful of white syrup. Mix well with a teacupful of warm (not hot) milk. Grate some nutmeg on it. Drink every morning fasting until cured. After taking the tonic patient should sleep for an hour or two before taking other food. Reason. In the after fast is the 'secret' of the cure. The germs have been fasting long. A dainty feast is served to them. They need time to enjoy its deliciousness but they are voracious gluttons and hog-like pitch right in and gorge until they burst so every dose diminishes their numbers to the great betterment of the patient."

Infantile Paralysis and influenza were the subjects engaging the attention of large numbers of correspondents during the epidemics which we remember as of recent occurrence. In connection with this we might say that although we have many times been brought to book by self-appointed critics for

conducting a Sanatorium and ignoring the wonderful specifics which our correspondents offered to us, we have never received any expostulations from those who call themselves anti-vaccinationists though we have at all times coöperated with the authorities urging the use of vaccination against smallpox and inoculation for typhoid fever.

Another "Professor" proffers his services to us as a "longevity expert" whose system seems to be reliance on the "laws of health physiologically under medical men and psychologically under men who recognize that the brain builds the body and determines how long we are to live." He tells us that people are so different that he must apply the laws after a "scientific analysis of character."

Prolongation of the lives of policy holders will result from the instruction of the insured in the means of "counteracting the deadly effect of a disorded splanchnic nerve" so we are informed by a gentleman who wants us to give him $600 or $800 to publish a book.

Notwithstanding the steady progress made in the knowledge of disease and its treatment by many scientific students, many ridiculous assumptions have been made by unqualified people of no experience and one of the most surprising is that known as "Chiropractic." Most of us have known very little about it until recently. In some localities the daily papers have been filled with advertisements of various "Chiropractors" and we have received from a City in the West the offer of an enthusiast to instruct all our examiners in the principles of the science. Once in a while a perfectly good chauffeur, or a skilled carpenter of whom we had knowledge, would disappear from his usual haunt and reappear after six or eight weeks as a full-fledged "Doctor of Chiropractic."

Recently in connection with a death claim submitted by my Company was the certificate of one of these practitioners to the effect that the deceased had received "Chiropractic adjustments" for pernicious anæmia during a period of three months.

The following extract from the Weekly Bulletin of the Department of Health of the City of New York of June 5, 1920,

gives probably the latest and most complete description of this surprising philosophy of disease and its treatment:

"CHIROPRACTIC" LEGALIZED IN JERSEY

"Members of the medical profession have long been at a loss to know just what 'chiropractic' is. They know what 'chiropractors' are, but 'chiropractic'—that has been a mystery! It remained for the Senate and General Assembly of the State of New Jersey to elucidate. An Act to Regulate the Practice of Chiropractic recently signed by the Governor of New Jersey gives to a palpitating medical world this vital information. Here is the opening paragraph of the act:

"Definition of Chiropractic: The term chiropractic when used in this act shall be construed to mean and be the name given to the study and application of a universal philosophy of biology, theology, thesophy, health, disease, death, the science of the cause of disease, and art of permitting the restoration of the triune relationships between all attributes necessary to normal composite forms, to harmonious quantities and qualities by placing in juxtaposition the abnormal concrete positions of definite mechanical portions with each other by hand, thus correcting all subluxations of the articulations of the spinal column, for the purpose of permitting the recreation of all normal cyclic current through nerves that were formerly not permitted to be transmitted, through impingement, but have now assumed their normal size and capacity for conduction as they emanate through intervertebral foramina—the expressions of which were formerly excessive or partially lacking—named disease."

There is, of course, possibility of harm to the more ignorant of our population as the result of these strange practices, and no doubt many of us are familiar with a few examples. The thing is growing and there should be concerted action which will fully enlighten the general public regarding health and disease. In no direction is this more needed than in the case of the teachings and practices of those who call themselves Christian Scientists. We do not discuss their theology—it is certainly

not Christian but their statements that all experience is subjective, that there is no such thing as matter and that what is generally called disease is nothing but a disordered sinful mental concept, hence the only cure for disease is the correction of the mental attitude. Those who hold these beliefs deny the efficiency of any and every preventive or curative agency now employed by the State to protect public health or by medical science to prevent suffering or eradicate or cure disease. They ignore the results of vaccination against smallpox, inoculation against typhoid fever or the wonderful results of antitoxin in diphtheria; with them there is no such thing as contagion or infection and they shut their eyes to the progress of preventive medicine in the study of consumption. Statistics, no matter how extensive or how accurately gathered, mean nothing to them and they calmly deny the most universally accepted experiences of human existence.

From the standpoint of life insurance it is a matter of no great importance how extravagant or illogical their ideas may be if the public health is not jeopardized thereby, but if, as seems to be indicated in one or two localities in this country, a grave danger to public welfare is immiment, it should cause the forces of intelligence to coöperate in combating these erroneous ideas and by the education of the public, generally, repel the assaults which are now being made.

In the State of California an insidious campaign is being conducted to nullify the important provision of the State Law which makes vaccination a condition for admission to any public school, college, university, or other educational institution or for the employment of any person in any public office and to accomplish this a constitutional amendment is to be voted on at the forthcoming November election. A copy of the circular agitating this subject follows, but it will be noted that there is no mention made of the Christian Scientists who are numerically so strong in California and who are back of this agitation.

A Free Child in a Free School

The Public School Protective League is circulating petitions to place a constitutional amendment on the November ballot to prohibit compulsory vaccination and inoculation of the public school children of California. This amendment provides that

> **No form of vaccination, inoculation or other medication shall hereafter be made a condition for admission to or attendance in any public school, college, university or other educational institution in this state or for the employment of any person in any public office. The provisions of this section shall not be controlled or limited by any other provision of this constitution.**

According to figures of the state board of health, 80% of the parents of California school children are opposed to the practice of vaccination and will not consent thereto. Under the present law these unvaccinated children are required to be admitted to school on the same terms as those vaccinated but they may be excluded under certain conditions, and during the past year the rights of both parents and children have been deliberately ignored in aid of the official campaign of propaganda to "popularize vaccination."

The proposed law does not seek to prohibit vaccination or any other form of medical treatment and the question of the efficacy of vaccination is not involved. The League contends however that as vaccination is a medically debatable practice which has been rejected by four fifths of the people of California, that no compulsion should be tolerated in its behalf.

A change in the law is also necessary in order to protect the rights of students at the State University, as the Courts have held that the present law does not apply to it.

After a trial of sixty-five years, the State of Victoria, Australia, has just abolished its compulsory vaccination law.

Compulsion in behalf of any form of medical practice is un-American and must go. Medical freedom as well as religious freedom is the basis of democracy.

It is the School that is Public—Not the Child.

The Public School Protective League

An organization of citizens interested in public school problems and having a membership embracing residents of every county in the state of every medical preference and religious opinion.

722 Van Nuys Building	**1007 Chronicle Building**
Telephone 13327	**Telephone Sutter 3155**
Los Angeles	**San Francisco**

If you desire to contribute to the expense of conducting this campaign, tear off and mail NOW to either office.

Name.....

Address.....

If this constitutional amendment should be carried other states may be asked to endorse similar or still more dangerous changes. The American Medical Association has already undertaken to oppose the enactment of this amendment and the American Public Health Association has the matter under serious consideration. The writer respectfully urges that this Association record its opposition to the proposed amendment to the Constitution of the State of California as being inimical to the public health and that it shall consider the advisability of appointing a permanent committee on Public Health which shall offer to coöperate with the American Medical Association, the American Public Health Association and any other organization of similar aims.

In order that decisive action may be taken at the forthcoming meeting in October, each Medical Director should canvass the subject fully with his Executive and the action decided upon shall represent the attitude of the Executives of all the companies represented in this Organization.

DISCUSSION

Dr. Symonds—Dr. Willard's paper is very timely indeed, and I think with reference to that legislative matter out in California that the Association ought to take some active measures to prevent the adoption of such an amendment. Dr. Willard tells me that his agency force has been at work for some time past. Now the amendment is one that is coming up at the election on the 2d of November, which gives us very little time to do anything, but I think the Association ought to put itself on record as being very much opposed to the adoption of such a law out there. I would therefore move, Mr. President, that this Association go on record officially as disapproving the adoption of the law repealing compulsory vaccination in California, and that the Secretary of the Association communicate such disapproval to the proper authorities.

Dr. Beckett—I second the motion, and I would like to say in this connection that these freak laws governing health in California may be largely accounted for by the inactivity of the medical profession on the coast. At our last legislature a law was passed permitting all osteopaths to practice medicine and surgery. About fifty or sixty of the leading physicians of California went to Sacramento and interviewed the Governor regarding the Osteopathic bill. Later the Governor vetoed the measure. We have now in the State of California a League for the Conservation of Health. It is backed up by the State Medical Society. It takes in, not only doctors, but many of the prominent people of our State, and it is doing most excellent work along this line. I think it is a unique organization. The physicians are subscribing largely to it. In one community 100% of the physicians in the community are members of the League, and I think it is safe to say that we have now, or will soon have, at least 75% of the physicians in the State as members of the League. I might say the League is now carrying on an energetic campaign against these freak measures that will be put on our ballot November 2d. I believe they will all be voted down. I simply mention this to you as a matter of

interest. I hope this question will pass and I would like to telegraph it to one of our chief workers in California. I am sure it will have considerable weight in helping to spread propaganda against these freak measures.

Motion Carried

(All of these bills against health measures were defeated.)

Dr. Patton—Mr. Chairman, I have practically nothing to add to what has been said on this matter excepting that I feel that with the large number of life insurance examiners scattered throughout the country, each of our companies could exert a considerable influence, through its own particular staff of examiners, on the communities in which those examiners reside, by getting in touch with them on the local public health measures. Recently, while in California, I learned of these matters which Dr. Beckett has mentioned, and I know that some of our examiners there are giving considerable time and undoubtedly exerting a great influence on the betterment of conditions. I think that wherever the opportunity comes to us, we can each one of us aid in that work.

Dr. F. C. Wells—Mr. President and Gentlemen, I am always glad to discuss a paper on a topic such as this by Dr. Willard who represents a company that has done much in pioneer work along educational and conservation of health lines. I believe that this is one of the most important questions before the American people to-day, and I am pleased that, at this meeting, the topic, "The Need of General Education in the Matter of Public Health," has been introduced.

As has been intimated in this discussion, there are so many different cults and theories in evidence to-day, all tinkering with the human machine, that there is grave danger of much harm resulting. You remember when our boys went over-seas, that very brilliant English writer, Mr. Gilbert Chesterton, prepared a little tract for their guidance and instruction, as well as welcome to the other side, and among other things he said that, "the wisest saying of the nineteenth century was by

an American named Artemus Ward, who once remarked "it ain't so much people's ignorance that does the harm as their knowing so many things that aren't so." The trouble with the American people to-day is not that we do not know, but that we know so many things that are not so.

As an illustration of what can be done along educational lines, take the National Safety movement that has swept through this country, a Council organized in every State, and in almost every district.

Last week two thousand men, captains of industry, gathered in a Western city, to consider how best the people of this land might be educated along the line of the preservation of life and limb. In conference for a week, the one idea was preventing death by accident. A little leaflet that fell into my hands called attention to this need. It stated that in the year 1919, 225 lives were lost daily in the United States, through accidents—82,000 lives in one year. Of this number, 22,000 occurred in the industries, while 60,000 were in the homes and on the street. Over 25% of these were children under ten years of age, and over four fifths of all acidents were of a preventable nature. Of 38,000,000 wage earners in the United States, 500,000 were so seriously injured by industrial accidents that they lost at least four weeks in time, or were permanently disabled. What a bill for America to pay! The facts stated above indicate that something may well be done along this line for the prevention of accidents. And the Life Insurance Companies are paying this bill in large measure.

The prevention of disease also is one of our big problems. We have only to go back to our own war record, of which we have heard to-day—33% of the boys who were called to the colors were found to be physically disabled, and the Surgeon General of the United States, states that the regrettable feature of it all was that 75% of these physical impairments were of a preventable nature.

Or take, for instance, the past influenza epidemic. The reason largely that it swept through this land and caused five hundred thousand new graves was due to the fact that the

American people were not prepared to meet and fight it, and after it had swept through the land, exacting so large a toll, then we began to warn and prepare to resist the disease. These are illustrations of the need of activity in health matters. I am mentioning these facts to emphasize what Dr. Willard has brought out in his paper, and what to my mind is the root of this whole thing, *i. e.*, the need of educating our mass of people and instructing them along lines that will improve the national health. I do not know why this should be necessary.

I do not know why it is that so many legislators in our different States manifest such an amazing degree of indifference on health matters, without apparently raising a hand to institute help, or why so many fathers and mothers in a State like California, for instance, should allow a referendum before the electorate of the people on the subject of compulsory vaccination.

The health of the American people is certainly a subject of sufficient importance as to engage the interest of the institution of life insurance. Dimes spent for this purpose will come back as dollars to our people, the value of which cannot be measured. Things that are of the highest value are hard to measure. Character cannot be put upon a coin basis, and yet it is beyond material computation.

I believe, most heartily, in the yearly physical examination. Dr. Willard has not said much about that, although I know that he is in favor of it.

A good many of our companies are endeavoring to create an influence that will lead policyholders to guard against incipient and insidious disease, not waiting until clinical manifestations drive them to seek advice. It is here that great service may be rendered.

Along this line maybe there is a possible explanation as to why so much of War Risk Insurance by the government has been dropped. In a news item the other day, I noticed that of twelve ex-soldiers killed by the bomb explosion in Wall Street, only two had government insurance, ten had let it lapse. I

cannot help but feel that the lack of personal interest and service to each man that is insured has something of an influence on the lapse rate that is taking place on that particular form of insurance.

I wish that every company represented in this Association might take the same view that is set forth in Dr. Willard's paper. We talk about the wealth of America, our farms, fields, and factories, our mines, mills, and men, but you can get nothing from these sources until it is brought forth by man power, for which the world to-day is waiting. It is calling for products that are brought forth by able-bodied men, and if America is falling down in this respect physically, America is going to fall from her place among the nations of the world. To be strong to-morrow, we must be strong to-day.

Dr. Symonds—I would like to ask Dr. Willard if there is anything else that the allied companies can do to help defeat this law. If there is, and if we could send word to our referees or perhaps to our agents, I know that our agency department would be glad to coöperate, if he has any ideas on that line.

Dr. Willard—No suggestions occur to me at present, but after I have fully acquainted myself with the manner of conducting the campaign by the Metropolitan and its results, I may be able to make some suggestions. Of course the agency force of the Metropolitan was largely employed to educate the voters by appeals to their common sense. Each agent visits day in and day out from 200 to 400 families each week and he has the means, and he has been exercising it, of influencing the voters on his debit. He has been showing his clients the wisdom of retaining on the statute books of the State of California the present law. I did not hope to excite definite action at this time in presenting this paper, but I did hope to get the Medical Directors and through them, the Executives of their companies, to think about this subject with the idea of procuring concerted action in utilizing the agency force of all the companies in the dissemination of pamphlets, special articles, in the participation of local representatives of companies in health movements in the communities in which they operate.

There is no use of mincing words or being too polite about the dreadful ignorance of the misguided people about whom we have been talking. There is no need of being deferential or being diplomatic in talking about absolute idiocy and when chiropractors and osteopaths and Christian Scientists are dealing with the most serious diseases that can confront human beings instead of intelligent scientific physicians, and are allowed to do so under the authority of the law, it is about time that the forces of intelligence should spread enough information to enable the common every-day people to see the wickedness of these ignorant assumptions of knowledge and the many bad results which have come from the use of them. It was only to get the subject started, and to ask that a committee, to be known as the Public Health Committee of the Association of Life Insurance Medical Directors, be appointed as a permanent part of our organization to collaborate and coöperate with the recognized agencies which have for their aim the protection of the health of the American people. I therefore make a motion that a committee of five be appointed by the chair, to be known as the Public Health Committee of the Association of Life Insurance Medical Directors, this committee to establish relations with all the known organizations which have for their purpose the protection of the health of the American people.

Dr. Toulmin seconded the motion, and it was carried.

Dr. Beckett—If you will allow me just one suggestion, following Dr. Symonds's question. I believe it would be really an excellent thing if the different companies would telegraph to their agents out in California to do what they can along the line of defeating these measures. We have also before the people this year an anti-vivisection law. I was in communication with the League for the Conservation of Health, and they assured me that they believed that all of these measures would be voted down, but you cannot always tell, and just a line

from some of your principal men out there might turn the tide in the right way.

Dr. Weisse—I think Dr. Beckett's suggestion is a very timely one, and I hope that the members of the Association will take it up with their Home Offices at once, that we may get started telegrams to the general agents of the different companies out in California. I hope the companies will all get busy along this line.

Dr. Weisse—Dr. Rogers and Mr. Hunter have given us another extremely valuable and instructive paper. Many years ago, Dr. Rogers began his series of papers on scientific selection, which have been followed by all of us with the greatest possible interest and to our very great advantage. The younger members of the Association find a great deal ready for them which they accept as facts, not realizing the amount of study and trial and tribulation by which these facts were worked out for them and to a very large extent by the two gentlemen to whom we owe our thanks for this paper to-day. As in many instances the question of occupation is not regarded as a purely medical one, Dr. P. Maxwell Foshay, Inspector of Risks of the Mutual Life Insurance Company, Mr. Ray D. Murphy, Associate Actuary of the Equitable Life Assurance Society, and Dr. Louis F. Dublin, Statistician of the Metropolitan Life, have been good enough to come to us to-day to discuss this paper from the point of view of their companies, as has Dr. Paul FitzGerald of the Prudential.

INFLUENCE OF OCCUPATION UPON MORTALITY

By Arthur Hunter and Dr. Oscar H. Rogers

The subject of the influence of occupation upon mortality is one which has been forced upon our attention more strongly in recent years than formerly. This is due to the great expansion in industry and to the increase in wages which has brought a larger percentage of the industrial population into the market for "ordinary" insurance where industrial insurance was formerly taken. In view of the increasing importance of occupation in the selection of risks we desire to present a schedule of the relative mortality in a considerable number of occupations. Such mortality is given in the form of ratios which are applicable to any system of selecting lives for insurance as they express the probable effect of the factor of occupation on mortality in each occupation. Incidentally those who wish to build up a system of numerical rating of risks will have the factor of occupation in addition to the basic ratings for build and for consumption in the family history, given by us in a paper read last October before the Actuarial Society of America and the Association of Life Insurance Medical Directors.

Within the limits of a single paper it is impracticable to present all of the occupations but our experience has shown that the list submitted will cover fully 95% of those coming before "ordinary" insurance companies and that probably the significance of many occupations not listed may be inferred from the ratio of similar or allied occupations that are given. In some of the occupations in our schedule no attempt has been made to differentiate between, or even make, different sub-occupations because there is practically no diversity in the hazard, while in other occupations from which applicants for insurance are more generally drawn the subdividions have been given for the sake of convenience. We do not claim that the schedule is complete in every detail but it has been found a satisfactory working basis for the last fifteen years with the modifications suggested by experience from time to time.

METHOD OF SHOWING RELATIVE MORTALITY

The statistics are presented in the same form as in the five volumes of the Medico-Actuarial Mortality Investigation, with the difference that the additions or subtractions from the central point of 100 are given and not the total mortality. Thus, the mortality in a hazardous occupation might appear as 150% in Volume III of the report on the Medico-Actuarial Mortality Investigation but in our schedule it would appear as +50; on the other hand, in the case of a favorable occupation which appeared in the former as 90% it would be shown in our schedule as −10. This seems a proper modification of the method used by the committee on the Medico-Actuarial Mortality Investigation as we deal solely with the effect of occupation on mortality. By means of the ratios in the schedule the relative mortality in each occupation is given in terms of our standard but may be applied to any company because it is fair to assume that the mortality in the various occupations will be approximately the same ratio of the normal mortality of the company as in the case of the New York Life Insurance Company. The method of presentation has the same merit as that used in the Medico-Actuarial Mortality Investigation, namely, the mortality ratios are applicable to any of the systems of selecting risks in general use in the United States and Canada.

SOURCES OF INFORMATION

The following is a summary of the sources from which our ratios of occupational mortality have been obtained in addition, of course, to the chief source—the extensive experience of our own company:

1. Medico-Actuarial Mortality Investigation, Vol. III.
2. Published reports of the experience of insurance companies.
3. Census statistics such as those published by the British Government in the supplement to the 65th Annual Report of the Registrar General, Part II.

4. Reports of beneficial orders, labor unions, and fraternal societies.
5. Reports by federal, state, and other officials in connection with the hazards of, and safeguards for, various occupations.
6. Pamphlets describing the hazards in various occupations such as the Monthly Bulletin of the U. S. Bureau of Labor, and the publications of the U. S. Public Health Service and such books as *Dangerous Trades* by Thomas Oliver.

But even after all these sources have been carefully studied and used, there still remain many occupations on which it is impossible to obtain a dependable mortality experience. Indeed, many may only be determined, as we have already suggested, by comparing them with similar occupations regarding which we have been able to secure definite knowledge. We freely acknowledge that in many occupations listed by us there is no statistical basis upon which to rest the mortality ratios assigned to them, but that we have determined them in the manner already referred to from their similarity to other occupations whose ratios are known. It will be noted that in some occupations the relative mortality has been based largely on the mortality among the class of the population from which the applicants are drawn. In many cases the small number of persons engaged in the occupation, or the small proportion of them who have insured in times past with the regular companies, accounts for the lack of definite information. Besides, in many industries, occupations are becoming so diversified as to make it extremely difficult to assign to each sub-occupation a precise ratio.

At this point it may be well to state that too positive statements regarding mortality in certain occupations are inadvisable because the conditions under which many occupations are carried on are in process of changing. The introduction of machinery and of safeguards against accident to the workers, and the rapid improvement of factory construction and sanita-

tion, all have been factors of importance in the problem. It is not unlikely too that the federal prohibition of alcohol must have a material influence on the rate of accident in those occupations in which a clear head and a steady eye are essential to safety. Again, some industries have increased greatly in importance during the last few years, and are now in the process of becoming highly specialized. For example, in the bulletin of the United States Bureau of Labor of December last, there appeared an interesting account of the dangers in some branches of the aniline dye industry. It is greatly to be regretted that there is no governmental agency engaged in the important work of the study of occupational mortality which would focus public opinion on improvements in the conditions for men and women in unhealthful or dangerous pursuits.

REASONS FOR MORTALITY DUE TO OCCUPATION

The differences of mortality in various occupations are due to three principal causes:

(*a*) Accident,

(*b*) Unhealthful circumstances of the employment itself,

(*c*) Unsanitary surroundings.

Many railway employees, for example, are exposed in the course of their daily work to accidents. The same is true of steel workers, employees on building construction, and the like.

In the category of unhealthful circumstances of the employment itself may be mentioned the occupation of stone cutting, in which the fine particles of dust induce changes in the lung tissue. Glass grinders and polishers are subjected to the same hazard, both from the particles of glass, and from those of the abrading powder. The fumes from chemicals, such as those from electric storage batteries and the poisonous effect of lead burning, would also come under (*b*).

Under the heading of unsanitary surroundings may be mentioned workers in cold storage warehouses, and other employees subjected to rapid changes of temperature such as rubbers in

turkish baths, workers in improperly ventilated mills and in factories built on swampy ground.

In some occupations there may be a combination of two or all of these factors. In the case of underground miners, for example, the death rate is not only high from accident, but is also high from penumonia, by reason of the rapid changes of temperature to which they are exposed, and possibly also to the rapid changes of atmospheric pressure. On the other hand the accidental death rate above the normal in certain occupations cannot be taken as the measure of the extra mortality because it may be partly offset by a low death rate from tuberculosis due to a healthful outdoor life.

INCIDENCE OF MORTALITY

On the actuarial side it is obvious that the extra hazard in some occupations may be represented practically by a constant addition to the normal death rate and on others by a percentage addition to it. Furthermore, in some occupations the increasing skill may result in a decrease in the constant addition after middle age while in other occupations the mortality may be truly represented by a percentage addtion at the younger ages which would decrease or become a constant at the older ages, due to the increasing ability to withstand the disease incident to the occupation. It is evident therefore that to attempt to prepare a schedule which would take into account all of these conditions would be impossible in our present state of knowledge; especially is this true of those occupations in which the amount of material available for analysis is too scanty. It is unfortunately true that there are few occupations in which the statistics in existence are sufficient to enable us to determine the incidence of mortality by age.

While the ratings in our schedule appear as percentages of the normal mortality the decreasing relative mortality of most occupations is recognized by our method of charging a smaller number of years advance in age for the same occupation after age 40 at entry. For convenience in practice, the same advance

in age is charged for all ages at entry up to age 40, but beyond that age no larger extra premium is charged than results from the specific advance in age at age 40. Thus, an advance of 7 years in age at age 40 on the Ordinary Life Plan becomes 5 years at age 50 at entry.

PERMANENT TOTAL DISABILITY AND DOUBLE INDEMNITY BENEFITS

The work of the actuary in connection with occupations has been greatly complicated by the introduction of total and permanent disability, and also by the more recent general accident double indemnity feature. There are certain occupations in which the liability to disease such as tuberculosis is greatly above the average which would make it inadvisable to grant permanent and total disability benefits. There are other occupations in which there would be no objection to granting these benefits but in which general accident double indemnity might not be granted by most companies on account of a high accident rate. There are still other occupations in which neither disability nor double indemnity is generally granted. In our Company the practice is indicated by letters which follow the rating for occupation. While reference to these benefits is not necessarily a part of this paper, we have not eliminated the letters from the ratings for the reason that our practice may be of help to others. At the beginning of the schedule for occupations will be found a key to the notation. An example or two will make our practice clear:

+10 A = insurance at regular rates of premium, with double indemnity and disability benefits,

+20 BD = insurance at regular rates of premium, with disability benefits and travel accident double indemnity, final decision on these benefits depending on the merits of each case,

+50 C = insurance at an advance in age but without either double indemnity or disability benefits.

In a number of occupations a specific mortality ratio is not given but the limits are indicated, thus, contractor for structural iron work, cypher *A* to +50 *C*. One applicant may never expose himself to any hazard, confining his work to office duties, while another may take an active part in supervising buildings under construction in which case an extra premium would be charged to cover 50 points extra mortality and no accident or permanent disability benefits would be allowed.

CONCLUSION

We shall like to repeat in conclusion what has been already referred to, namely, that for practical reasons our schedule does not attempt to differentiate the mortality according to its incidence by age. We are fully aware of the inconsistency of representing the morality by a percentage of the normal mortality in all cases but, if desired, the material in the schedules can be transformed into constant additions to the normal by assuming an average age at issue and a duration of 15 or 20 years. We sincerely trust that as a result of the publication of our statistics, the practice of other companies will be given so that we may all add to our knowledge with regard to the treatment of occupational mortality.

Schedule of Numerical Ratings for Various Occupations.

Key to Notation

	Disability Benefits	Travel Accident Double Indemnity Benefits	General Accident Double Indemnity Benefits
A	yes	yes	yes
B	yes	yes	no
C	no	no	no
D	"Depending upon merits of the case."		
E	yes	no	no
F	no	no	yes
G	no	yes	no

R. N. A. = Risk not acceptable.

\+ Occupation = Particulars of occupation should be sent to Home Office.

* = Will consider for 20 Year Endowment Insurance without advance in age, but the Disability and Double Indemnity Benefits will be granted only if the symbols opposite the rating permit of these features.

A

ACCOUNTANTS	0A
ACID MAKERS.	
Muriatic, Nitric, and Sulphuric	+ 100C
ADJUSTERS (if non-hazardous)	0A
AGENTS—not peddlers	0A
AMUSEMENTS AND SPORTS.	
Aviators and Aeronauts	+Occupation
Baseball players—professional	+ 30C
Bicyclists—professional	+ 100C
Billiard and Pool Parlors and Bowling Alleys (Where no liquor is sold.)	
*Proprietors, *Managers, and *Clerks (See Liquor Class.)	+10A to + 50A
Circus.	
Acrobats, Circus Performers, Trapeze Performers, on ground	+ 50C
Acrobats, Circus Performers, Trapeze Performers,—aerial	+ 150C
Bareback Riders	+ 50C
Horse-Racing.	
Book-maker	+ 60C
Horse-trainer—in charge of stable	+10A to + 50C
Jockeys	+ 150C
Stablemen—employees	+ 75C
Starter	+ 50C
Steeplechase Riders	R. N. A.

AMUSEMENTS AND SPORTS.—*Continued*	
Theatrical Employees.	
*Actors and *Actresses	+ 40A
*Booking Agents	+ 40A
*Box Office Employees	+ 40A
*Managers and *Proprietors	+ 40A
*Musicians (Orchestra)	+ 40A
*Scene Painters and *Mechanics	+ 40B
Moving Pictures and Slot Machines.	
Proprietors and Managers of Theaters	+ 15A
*Actors and *Actresses	+40BD
Cinematograph Operators	+ 40B
Camera-men	+40BD
Prize Fighters	+100 up C
Wrestlers and Jiu-Jitsu	+ 100C
APOTHECARIES.	
Proprietors and Clerks	+ 10A
APPRAISERS	0A
ARMY—U. S.	
Chaplains	+ 10C
Commissioned Officers (excluding aviators), Cadets, Surgeons, Paymasters, Clerks, Musicians, and Hospital Stewards	+ 40C
Non-Commissioned Officers, Farriers, Harness-makers, Saddlers, Curriers, Veterinaries	+ 60C
Gunners, Ordnance-men, and Soldiers	+ 80C
ARTISTS	0A
ASBESTOS WORKERS—See Mines.	
ASSAYERS	+ 15A
ASSESSORS	0A
ASTRONOMERS	− 20A
ASYLUMS, HOSPITALS, AND SANITARIUMS—Non-contagious.	
Managers, Superintendents, and Housekeepers	+ 0A
Physicians	+ 10A
Nurses and Attendants—Women	+15AD
*Male Nurses and Orderlies	+40BD
Porters and Servants in	+40BD
ASYLUMS, HOSPITALS, AND SANITARIUMS—Contagious.	
Managers, Superintendents, and Housekeepers	+ 20A
Physicians	+ 10A
Nurses and Attendants—Women	+30BD
Male Nurses and Orderlies	+40BD
Porters and Servants in	+40BD
ATHLETIC INSTRUCTORS	0A
AUCTIONEERS	0A

AUDITORS ..... − 5A
AUTHORS AND EDITORS ..... −5A to − 15A
AUTOMOBILE.
Factory.
Proprietors and Managers 0A
Skilled Employees ..... + 10A
Testers—road work ..... + 35C
Garage.
Proprietor and Foreman ..... + 10A
Machinists (skilled), Repairmen, and Vulcanizers ..... + 15D
Salesmen, who occasionally demonstrate ..... + 15A
Chauffeur.
Demonstrating ..... + 20B
*Private—Delivery and Express ..... +15BD
*Public and Omnibus ..... + 40C
*Truck ..... + 40B
Racing ..... R. N. A.
Motor Pacer ..... R. N. A.
AVIATORS, AIRDOME AND HANGAR EMPLOYEES ..... +Occupation

B

BAKERS.
Proprietors 0A
Foremen ..... +10A to + 20A
*Journeymen ..... +15A to + 30A
BALLOONISTS ..... +Occupation
BANKERS.
Bank Officers ..... − 10A
Clerks 0A
Examiners—not Clerks ..... − 10A
Messengers or Collectors ..... + 10A
Private Bankers ..... −10A to + 10A
BARBERS.
Proprietors ..... + 5A
Journeymen ..... + 15A
BARGEMEN—See Marine Service.
BATH ATTENDANTS.
Office and Clerical ..... + 15A
Shampooers and Rubbers ..... + 30A
BEEF INDUSTRY.
Butchers—Retail.
Proprietor 0A
Journeymen ..... + 15A
Wholesale—
Workers in Cold Storage ..... + 30C

BEEF INDUSTRY.—*Continued*
Stock Yards.
Butchers, Shavers, and Skinners ..... + 75C
Canners, Cutters, and Yardmen ..... + 40B
Foremen ..... + 15A
Kosher (Rabbi) ..... + 15B
BICYCLE—See Amusements and Sports.
BILL POSTER.
Proprietor ..... + 10A
Employees ..... + 40C
BLACKSMITHS.
In Shops 0A
Occasional Horseshoers ..... + 15A
Horseshoers ..... + 30B
BLEACHERY WORKERS—See Dyers.
BOARDING-HOUSE KEEPERS 0A
BOATHOUSE PROPRIETORS 0A
BOILER INSPECTORS 0A
BOILER-MAKERS, COLD IRON ..... + 15C
BONE AND IVORY TURNERS AND CUTTERS ..... + 10A
BOOK AGENTS 0A
BOOKBINDERS.
Proprietors 0A
Foremen and Journeymen ..... + 10A
BOOKKEEPERS 0A
BOOT-BLACKS.
Proprietors ..... + 20A
Foremen and Journeymen ..... + 40C
BOTTLE WASHERS IN CREAMERY ..... + 10A
BOTTLING INDUSTRY—Non-Alcoholic.
Proprietors and Managers ..... + 10A
Employees (ordinary) ..... + 20A
Employees (who wear masks) ..... + 40C
BOWLING ALLEYS—See Amusements and Sports.
BRICK WORKS.
Foremen ..... + 10A
Skilled Workmen ..... + 20B
Unskilled Employees ..... + 40C
BROKERS, Including Exchange Officials and Members of Firm 0A to + 10A
BUFFERS—See Metal Trades.
BUILDINGS.
Archiects ..... − 10A
Artisans ..... + 10B
Bricklayers and Masons ..... + 10B
Builders 0D

BUILDINGS.—*Continued*

Carpenters.
- Proprietors 0D
- Journeymen ..... + 10B

Contractors (unless specially hazardous) 0A

Cornice-setter ..... +30C to + 75C

Diamond-drill (Foundations, not Caisson).
- Boss Operator ..... + 10A
- Drill-setter, Skilled Workmen on Drill, and Mechanics .... + 15B
- Laborers ..... + 40C

Draftsmen 0A

Elevator Construction.
- Proprietors 0D
- Foremen ..... + 40C
- Skilled Workmen ..... + 50C
- Other Employees ..... + 50C
- Foremen and Workmen installing electric fixtures in cars and elevators ..... + 50C

Ornamental Work on Elevators.
- Foremen ..... + 10B
- Skilled Workmen ..... + 30C

Engineers—Stationary ..... + 15B

Inspectors ..... + 5A

**Janitors* ..... +10A to + 40A

Laborers ..... + 40C

Locksmiths ..... + 10A

Masons ..... + 10B

Painters.
- Proprietors ..... + 5D
- Foremen ..... + 10B
- Journeymen—ordinary work ..... + 15B
- Journeymen on high buildings and structural iron work. +30C to + 75C

Paper Hangers.
- Proprietors ..... + 5D
- Foremen ..... + 10B
- Journeymen ..... + 15B

Plasterers ..... + 10B

Plumbers, Steamfitters, and Gasfitters.
- Proprietors 0A
- Journeymen ..... + 10A

Roofers (depending on height of building) ..... +30C to + 75C

Structural Iron-Workers.
- Superintendents and Contractors ..... 0A to + 50C
- Foremen ..... + 75C

BUILDINGS.—*Continued*
Structural Iron-Workers.—Continued
Painters..... + 75C
Skilled Workmen..... + 100C
Housesmiths who build stairways and fire escapes..... + 75C
Time-keepers..... + 15A
Watchmen.
Day, if first-class in every respect..... + 25A
Night..... + 40B
Window-cleaners.
Proprietors, depending on whether they personally clean windows or not..... +15D to + 75C
Employees..... R. N. A.
Wreckers—House.
Proprietors and Managers..... + 20D
Employees..... + 50C
BUTCHERS—See Beef Industry.
*BUTLERS..... +15A to + 30A
BUTTER MAKERS..... + 5A
BUYERS—Merchandise..... 0A

C

CABINET-MAKERS..... + 10A
CAISSON WORKERS..... R. N. A.
CANDY MAKERS—See Confectionery.
CARPET-LAYERS..... + 10A
CARTRIDGE WORKERS—See Explosives.
CARVERS—Hand-work only..... 0A
(Machine work—See Factory employees.)
CASHIERS.
Retail Stores..... + 10A
Large Commercial Establishments..... 0A
CATCHERS—See Metal Trades and Industries.
CATERERS.
Proprietors..... 0A
Employees—See individual occupations.
CATTLE BUYERS AND DEALERS..... 0A
CATTLE DROVERS.
Proprietors..... 0A
Employees..... + 40B
CELLULOID MAKERS AND WORKERS—See Factory.
CEMENT FLOOR AND CEMENT WALK LAYERS.
Skilled Workmen..... + 10A
CEMENT MILL EMPLOYEES.
Proprietors and Managers..... + 20A

CEMENT MILL EMPLOYEES.—*Continued*		
Foremen	+	50C
Workmen	+	75C
CHARCOAL WORKERS.		
Skilled	+	20B
Unskilled	+	40C
CHAUFFEURS—See Automobile.		
CHEESE MAKERS	+	5A
CHEFS—See Cooks.		
CHEMISTS—Not connected with explosives	+	15D
CHIROPODISTS	+	10A
CHIROPRACTORS	+	10A
CIGAR MAKERS—See Factories.		
CLAIRVOYANTS, PALMISTS, ETC	+	20A
CLAY WORKERS—See Pottery Industry.		
CLERGYMEN	−	25A
CLERKS IN OFFICES OR IN CIVIL SERVICE		0A
CLOTH EXAMINERS		0A
CLUBS—See Hotels, Restaurants, and Clubs.		
COACHMEN—See Drivers.		
COACHBUILDERS	+	10A
COAL HEAVERS IN YARDS—Not Railroads	+	50C
COAST GUARD.		
Commissioned Officers, Line and Engineer Corps	+	10B
District Superintendents	+	10A
Warrant Officers	+	15B
Petty Officers	+	20B
Surfmen, etc.	+	15B
Other Enlisted Men	+	40B
COBBLERS	+	15A
COFFEE ROASTERS	+	10A
COKE BURNERS.		
Skilled	+	20B
Unskilled	+	40C
COLD STORAGE—Employees who enter storage rooms	+	30C
COLLECTORS—Also see Liquor		0A
COLOR MAKERS AND COLOR MIXERS—See Factory—Aniline.		
COMPOSITORS	+	15A
COMPRESSED AIR WORKERS	R. N. A.	
CONCENTRATE MILLS—See Mining.		
CONCRETE BLOCK MAKERS.		
Skilled workmen	+	10B
Unskilled workmen	+	40C
CONFECTIONERS.		
Proprietors		0 A

CONFECTIONERS.—*Continued*
Foremen ..... + 10A
Journeymen ..... + 15A
CONSTABLES—See Police.
CONTRACTORS, unless special hazard 0A
COOKS (Where no liquor is sold).
Camp and Country ..... + 20B
Club and Lunch Counter ..... +15A to + 30A
*Domestic ..... +15A to + 30A
Lumber Camp ..... + 20B
COOPERS, not connected with Liquor Industry ..... + 10A
CORE MAKERS ..... + 15B
CORNICE MAKERS—Shop Work only—See also Buildings ..... + 10A
COTTON INSPECTORS, SAMPLERS, AND CLASSERS 0A
COTTON GIN MILL.
Foremen and Journeymen ..... +15A to + 40B
CRANESMEN—See also Railroad.
In charge on ground ..... + 15B
Helper on ground ..... + 30B
On Bridge in Mills, on Steam Shovel, and in Building Construction ..... +20BD
CURATORS ..... − 10A
CUSTOM-HOUSE OFFICIALS AND CLERKS 0A
CUTLERS—See Metal Trades.

D

DANCING TEACHERS ..... + 10A
DECORATORS.
Artists 0A
Artisans ..... + 15B
DELIVERYMEN, not in connection with alcohol or hazardous occupation ..... +15BD
DENTISTS ..... + 10A
DEPARTMENT STORES.
Heads of Departments, Accountants, and Buyers 0A
Clerks, Salesmen, and Saleswomen ..... + 10A
DESIGNERS 0A
DIAMOND CUTTERS OR POLISHERS ..... + 10A
DIVERS ..... R. N. A.
DOCK CONSTRUCTION.
Builders and Carpenters ..... + 30B
Laborers ..... + 70C
*DOMESTIC SERVANTS ..... +15A to + 30A
DRAFTSMEN 0A

DRAYMEN.
- Proprietors ..... + 15A
- *Employees ..... + 40B

DREDGERS—Not Mining.
- Officers and Engineers ..... + 10B
- Firemen ..... + 30B
- Workmen ..... + 50C

DRESSMAKERS.
- Proprietors ..... + 10A
- Workers ..... + 20A

DRIVERS.
- Ambulance ..... + 30B
- *Cabmen and Hack Drivers ..... + 40C
- Coachmen, private ..... + 15A
- Delivery and Express ..... +15BD
- *Horse-car ..... +40BD
- *Ice Wagon ..... + 40C
- Junk Wagon ..... +20A to + 50C
- Milk Delivery ..... +15BD
- Soft Drinks ..... +15A to + 50C
- *Teamsters, Truckman, Cartmen (See also Liquor) ..... + 40B

DRUGGISTS—Proprietors and Clerks ..... + 10A

DYERS AND BLEACHERS.
- Proprietors 0A
- Workers ..... +30AD

DYNAMITE—See Explosives.

E

ELECTRICAL INDUSTRY.
- Contractors, Superintendents, Managers, and Electrical Engineers, who do not handle live wires 0A
- Contractors, Superintendents, Managers, and Electrical Engineers, who handle wires ..... + 30B

Those who climb poles, or handle wires used for high voltage currents.
- Armature Winders making tests ..... + 40B
- Cable Splicer ..... + 60C
- Carbon Trimmer ..... + 60C
- Construction Foremen ..... + 40B
- Electricians in Mines ..... + 70C
- Light Inspectors ..... + 30B
- Linemen ..... + 70C
- Stationary Engineer ..... + 40B
- Troublemen with Telephone Company—outside work ..... + 60C

ELECTRICAL INDUSTRY.—*Continued*
Power House.
Mechanics, Engineers, and Foremen ..... + 40B
Oilers, Dynamo Tenders, and Firemen ..... + 60C
Power Inspectors ..... + 50C
Switchmen, Operators on Transformers, and others handling high voltage ..... +60C to + 100C
Those who do not climb poles or handle wires used for high voltage.
Armature Winders and Core Makers ..... + 15B
House Wiremen, Telephone Inspectors, Telephone Wiremen, and Wire Chief ..... + 10A
Storage Battery Workers ..... + 40C
ELECTROPLATERS ..... + 15A
ELEVATED RAILROAD SERVICE—See Railroad Class.
ELEVATORS IN BUILDINGS—See also Buildings.
Attendants ..... +10A to + 30C
Inspectors ..... + 10A
EMBALMERS ..... + 15A
EMBOSSERS—Leather ..... + 10A
EMBROIDERY WORKERS.
Stamping, if not using lead ..... + 20A
EMERY CLOTH AND PAPER MAKERS ..... +10A to + 50C
EMERY WHEEL.
Grinders ..... + 75C
Wheel Testers ..... + 40C
ENAMELING JEWELRY ..... + 10A
ENAMEL WARE WORKERS—depending partly on use of lead. +30B to + 75C
ENGINEERS.
Civil ..... − 5A
Civil—on Caisson work.
Who occasionally go in air locks ..... + 75C
Who do not go in air locks ..... + 30B
Mechanical—in Mines—See Mines.
Mechanical—not in Mines 0A
Stationary, unless in railroad or other hazardous work ..... + 15D
ENGRAVERS.
Metal, Photo, Stone ..... + 10A
Glass ..... + 55C
ETCHERS.
Artists 0A
Artisans ..... + 10A
EXCISE AGENTS AND INTERNAL REVENUE COLLECTORS .. +10A to + 100C
EXPLORERS ..... R. N. A.

EXPLOSIVES—Powder and Dynamite.

Office men whose duties do not take them to the plant, and in buildings situated at least half a mile from works	+ 15B
Office men whose duties take them occasionally to the plant, or in buildings situated less than half a mile from works	+ 30B
Superintendents and Chemists	+ 45C
Skilled Mechanics, Engineers, Plumbers, Carpenters, Steam-fitters	+ 65C
Foremen, Acid-house Employees, Outside Gang, Warehouse-men, and Carters of Explosives	+ 75C
Cartridge Factory.	
Machine Operators filling Cartridges	+ 75C
Workers who handle poisonous chemicals	+ 75C
Those who break up condemned articles	+ 125C
Fulminate Mixers, Nitro-Glycerine workers	+ 175C
Fuse Factory.	
Superintendents and Foremen	+ 40C
Employees	+ 60C

EXPRESSMEN—See Drivers.

F

FACTORIES AND INDUSTRIES.

Ordinary, such as:

Acetate of Lime	Knitting
Alcohol, wood	Leather
Barrel	Linoleum
Brush and Broom	Mattress
Carpet	Oilcloth
Cotton	Shoe
Clothing	Silk
Cigar and Cigarette	Shirt
Cordage	Tannery
Cotton Seed Oil	Underwear
Furniture	Watch
Glove	Wool
Gun	

Proprietors	0A
Superintendents and Managers	+ 5A
Foremen	+ 10A
Skilled men	+ 15A
*Skilled women	+ 30A
Unskilled laborers	+ 40C
Aniline—Manufacture of.	
Chemists	+ 40D
Skilled workmen	+ 50C
Unskilled	+ 65C

FACTORIES AND INDUSTRIES.—*Continued*

Celluloid Factory.

Same as other factories except those employed in acid room or exposed to special danger.

Workers in acid room ..... + 40C

Cartridge Factory—See Explosives.

Fuse Factory—See Explosives.

Hat.

Proprietors, Superintendents and Managers ..... + 5A

Foremen ..... + 20F

Skilled Workmen ..... + 40F

Match Factory.

Superintendents ..... + 10A

Foremen ..... + 30B

Dippers and Dryers ..... + 90C

All other operatives ..... + 60C

Millwrights ..... + 10B

Needle makers ..... + 30C

Paint Factory.

Superintendents and Managers ..... + 10A

Skilled Workmen ..... + 40C

Paper and Pulp Mill Operatives.

Skilled workmen, if first-class in every respect ..... + 15A

Ordinary workmen in cellulose plant and in acid department + 40C

Rag sorters and Rag dusters ..... + 60C

Skilled women employees ..... + 40D

Rubber.

Skilled workmen, if first-class in every respect ..... + 15A

Those using Aniline ..... + 50C

FARMERS, AGRICULTURISTS, BEE KEEPERS, AND DAIRYMEN.

Proprietors ..... − 15A

Laborers 0A

(In seven Southern States: S. Carolina, Mississippi, Georgia, Louisiana, Florida, Arkansas, and Alabama—no credit for occupation of farmer.)

FINISHERS—See Metal Trades and Industries.

FIRE DEPARTMENT EMPLOYEES.

Officers ..... + 30C

Firemen, Laddermen, Pipemen, and Hosemen ..... + 45C

Drivers, Engineers, Stokers, and Truckmen ..... + 45C

FIREMEN—Stationary.

Not connected with hazardous occupation ..... + 20D

FISHERMEN.

In-shore and Bay.

Officers and men ..... + 15B

FISHERMEN.—*Continued*
Deep Sea, except Grand Banks.
Officers and men ..... + 40C
Grand Banks.
Officers and men, depending on other occupation, if any.
+50C to + 100C
FLORISTS.
Producers—Proprietors ..... — 10A
Producers—Workmen 0A
Merchants 0A
*FOOTMEN ..... +15A to + 30A
FORGEMEN—See Metal.
FORESTERS 0A
FOUNDRYMEN—See Metal.
FURNITURE MOVERS.
Proprietors ..... + 15D
Employees ..... + 40C
FURRIERS.
Proprietors 0A
Skilled Workmen ..... + 40F
FUSE FACTORY—See Explosives.

G

GAME WARDEN 0AD
GARAGE EMPLOYEES—See Automobiles.
GAMBLERS—Professional.
Proprietors ..... + 50C
Employees ..... + 90C
GARDENERS.
Proprietors ..... — 10A
Workers 0A
GAS MAKERS ..... + 40C
GAS WELLS.
Stationary Engineers ..... + 10A
Tool Dressers and Blacksmiths ..... + 15A
Foremen, Gaugers, Pipemen, and Pumpmen ..... + 15A
Drillers using no explosives ..... + 15A
Drillers and Shooters using explosives ..... + 80C
GAUGER ..... + 15A
GILDERS ..... + 15A
GLASS INDUSTRY.
Foremen and Superintendents ..... + 10A
Blowers using machinery ..... + 30B
Blowers not using machinery ..... + 55C

GLASS INDUSTRY.—*Continued*

Cutters, Bevelers, Grinders, Polishers, Roughers, and Dippers	+	55C
Mirror Makers and Silverers	+	55C
Plate Glass and Window Glass Cutters	+	20A
Pot Maker	+	30B
GLAZIERS—Not in potteries	+	10A
GOLF INSTRUCTORS	−	10A
GOVERNMENT OFFICIALS AND EMPLOYEES		0A
GRAIN ELEVATORS.		
Proprietors, Superintendents, and Managers	+	10A
Foremen	+	30B
Warehousemen and other employees	+	50C
GRANITE, STONE, SLATE, AND MARBLE WORKS.		
Granite.		
Boxers, Graders, Shippers, and Yardsmen	+	15B
Derrick Men	+	30B
Engineers and their helpers	+	20B
Granite Cutters—with Chisel	+	50C
Granite Workers at quarries, non-blasting	+	40C
Granite Workers at quarries, blasting	+	75C
Polishers and Rubbers	+	20B
Tunnel Workers, Drillers, and Chainmen	+	40C
Marble.		
Boxers, Graders, Shippers, and Yardsmen	+	15B
Carvers, Cutters, and Tracers	+	50C
Laborers in quarries	+	50C
Machine Runners and Helpers in quarries	+	40C
Polishers, Sawyers, and Rubbers	+	20B
Slate.		
Quarrymen, not using explosives	+	40C
Stone Planers	+	50C
Workers, in Mills, including Splitters	+	20B
GROCERS.		
Proprietors		0A
Clerks and Salesmen	+	10A
GROOMS	+20D to	+ 40B
GUIDES	0A to	+ 50C
GYMNASIUM TEACHERS		0A

H

HAIR-DRESSERS—Not Barbers	+	10A
HAIR WORKERS	+15A to	+ 40C
HORSESHOERS—Journeymen	+	30B
HORSE-TRAINERS—See Amusements and Sports.		

HORSE DEALERS..... + 10A
HOSPITALS—See Asylums.
HOSTLERS—Private Service..... +20D to + 40B
In livery stables..... + 50C
HOTELS, RESTAURANTS, AND CLUBS.
(Where no liquor is sold.)
Proprietors, Managers, and Superintendents..... 0A to + 20A
Bell Boys..... + 15A
Clerks (clerical duties only)..... 0A to + 20A
*Cooks and Chefs..... +15A to + 30A
*Hotel Servants..... +15A to + 30A
Waiters—Men..... + 40A
*Waiters—Women..... +10A to + 30A
(See Liquor.)
HOUSEKEEPERS.
In Hotels and Boarding Houses..... 0AD
HOUSEMOVERS..... + 75C
HOUSEWIVES..... 0F
HOUSEWIRERS..... + 10A
*HUCKSTERS..... +10A to + 30A

I

ICE HARVESTERS.
Proprietors..... 0A
Workmen..... + 50C
ICE MAKERS (artificial)..... + 50C
INSANE ASYLUMS—See Asylums, Hospitals, etc.
INSPECTORS—See Specific Occupation.
INSTRUCTORS—See Athletic, Dancing, Gymnasium, Teachers.
INSURANCE OFFICIALS..... − 5A
INTERPRETERS..... 0A

J

JAILERS—See Prisons.
*JANITORS..... +10A to + 40A
JEWELERS.
Proprietors..... 0A
Journeymen..... + 10A
Silversmiths..... + 10A
Gold Beaters and Refiners..... + 15A
JOCKEYS (not Steeplechase)..... + 150C
JOURNALISTS (not reporters)..... − 5A
JUDGES..... −5A to − 15A

JUNK DEALERS.
- Proprietors ..... 0A to + 25A
- Streetmen ..... +25A to + 50C

K

KILN BURNERS—See Potteries.

L

LABORERS (See also special class.)
- Farm 0A
- Unskilled ..... + 40C

LACE MAKERS—Not Factory ..... + 15A

LACQUER WORKERS.
- Wood ..... + 10A
- Metal ..... + 25A

LANDSCAPE GARDENERS ..... − 10A

LAUNDRY.
- Proprietors 0A
- *Workers ..... +20A to + 40A

LAWYERS ..... − 5A to − 15A

LECTURERS 0A

LETTER CARRIERS 0A

LIBRARIANS 0A

LIFE SAVING SERVICE (See Coast Guard.)

LIGHTHOUSE KEEPERS ..... + 5B

LIGHTHOUSE SERVICE ..... + 15B

LIME BURNERS ..... + 50C

LINOLEUM FACTORIES—See Factories.

LIQUOR—Manufacture or Sale of.

Beer Pumps.
- Salesmen ..... + 70A
- Repairers ..... + 90C

Billiards, Pool, and Bowling Alley.
- Proprietors, Managers, and Clerks ..... + 70A
- Bartenders ..... + 90C

Bottlers of Beer.
- Proprietors, Managers, and Clerks who do not solicit for business or make collections ..... + 50A
- Proprietors, Managers, and Clerks who solicit for retail trade or make collections ..... + 70A
- Foremen, Journeymen ..... + 70A
- Divers, Laborers ..... + 90C

Breweries.
- Proprietors and Managers—financial duties only ..... + 10A

LIQUOR—Manufacture or Sale of.—*Continued*

Breweries—Continued

Other Proprietors and Managers	+ 35A
Superintendents	+ 35A
Clerks	+ 35A
Collectors and Traveling Salesmen visiting wholesalers and jobbers	+ 40A
Collectors and Traveling Salesmen visiting retail stores	+ 70A
Coopers, Brewmasters, Engineers, and Firemen	+ 50A
Journeymen, Maltsters	+ 70A
Drivers, Laborers	+ 90C

Distilleries.

Proprietors, Managers, Clerks, and Superintendents	+ 10A
Collectors and Traveling Salesmen who deal with retail trade	+ 70A
Collectors and Traveling Salesmen who sell warehouse certificates to wholesalers and jobbers	+ 40A
Compounders of liquors	+ 40A
Engineers and Mechanics	+ 40A
Foremen and Other Employees	+ 50A

Family Liquor Stores and Mail Order Houses.

(Where liquor is sold in sealed packages only.)	
Proprietors, Managers, and Clerks	+ 30A
(Where liquor is sold by jug or in unsealed packages.)	
Proprietors, Managers, and Clerks	+ 50A

Grocers with Bar.

Same as Saloonkeepers.

Hotels, Restaurants, and Clubs with Bar.

(If first-class of large size.)	
Proprietors, Managers, and Clerks who do not personally serve liquor	+ 20A
(Average.)	
Proprietors, Managers, and Clerks who do not personally serve liquor	+ 50A
(All types.)	
Proprietors, Managers, and Clerks who tend bar occasionally	+ 70A
Proprietors, Managers, and Clerks who tend bar regularly	+ 90C
Cooks and Chefs	+20A to + 55A
Waiters	+ 70A
Servants and Bell-boys	+ 30A
Musicians	+15A to + 50A
Stewards	+30A to + 70A
Bartender	+ 90C
Porters	+ 100C

Maltsters.

Who have been connected with brewery within five years	+ 35A
Who are now connected with brewery	+ 70A

LIQUOR—Manufacture or Sale of.—*Continued*

Vineyard Employees.

Depending on handling of wine..... +10A to + 30A

Saloons.

Proprietors and Managers not tending bar regularly..... + 70A
Tending bar regularly..... + 90C
Bartenders..... + 90C
Porters..... + 100C

Wholesale Houses.

Proprietors and Managers, financial interest only..... + 15A
Clerks, Cashiers, and Bookkeepers..... + 30A
Proprietors, Managers, Clerks, and office force who occasionally solicit for business or make collections..... + 40A
Traveling Salesmen and Collectors who sell to wholesalers and jobbers only..... + 40A
Traveling Salesmen and Collectors who deal with retail trade + 70A
Winehouse Cellarmen..... + 90C

LITHOGRAPHERS..... + 15A

LIVERY STABLE.

Proprietors..... + 25A
Hostlers..... + 50C
*Other Employees..... + 40B

LONGSHOREMEN AND LIGHTERMEN

Overseers..... + 20A
Employees..... + 50C

LUMBER.

Cooks in Camp..... + 20B
Dressers, Graders, Lumbermen..... + 10B
Piler, Scaler, Tracker..... + 10B
Inspectors and Foremen..... + 10A
Skidder Foremen..... + 20B
Loggers—who ride logs or work on booms..... + 50C
Riggers and Rigging Slingers..... + 50C
Raftsmen, Cable Operators, Hook Tenders, and Skidders.. + 50C

M

MACHINISTS—Unless special hazard..... + 10B
MANICURISTS..... + 20A
MANAGERS—Unless in hazardous occupation..... 0A
MANUFACTURERS—Unless in hazardous occupation..... 0A
MARBLE WORKERS—See Granite Workers.
MARINE CORPS.

Commissioned Officers (excluding aviators), Surgeons, Musicians, Paymasters..... + 40C
Non-Commissioned Officers, Electricians..... + 60C
Ordnance Men and Enlisted Men..... + 75C

MARINE SERVICE.

Ocean Liners.—3000 or more gross tonnage plying within Temperate Zone—not Tramps.

Captains, 1st, 2d, and 3d officers	+	10B
Physicians, Pursers, Chief Stewards	+	10B
Engineers, 1st and 2d	+	10B
Machinists	+	50C
Stewards and Cooks (no liquor served)	+	50C
Stewards and Cooks (liquor served)	+	70C
Sailors, Oilers, and Water-tenders	+	75C
Stokers	+	100C

Ocean Steamers of less than 3000 tons plying within Temperate Zone.

Officers, Engineers, Pursers, Physician, Chief Steward	+	30B

Others same as on larger ships.

Tramps and Steamers going to Tropics. Apply above ratings + proper tropical rate.

Ocean and Great Lakes—Sailing.

Officers, including Pursers	+	60C
Stewards and Cooks	+	75C
Sailors	+	100C
Captain on Smack	+	60C

Great Lakes—Steam.

Officers and Engineers on steamers of regular lines of 2000 or more tonnage	+	10B
Officers and Engineers on steamers of regular lines of less than 2000 tons or on tramp steamers of any tonnage	+	30B
Wheelmen and Oilers irrespective of size of steamers	+	40C
Bargemen—Captain	+	50C
Men	+	75C
Cooks on freight steamers	+	50C
Cooks and Stewards on passenger boats where alcohol is served	+	70C
Sailors	+	60C
Stokers	+	75C

River and Harbor Craft.

Officers, Pilots, and Engineers	+	10B
Bargemen—Captains	+	10B
Boatmen	+	40B
Machinists	+	30B
Cooks (no liquor served)	+	30B
Cooks (liquor served)	+	70C
Sailors, Stokers, and Roustabouts	+	40B

Revenue Cutters—See Coast Guard.

Wireless Operators—Treat as Officers.

Wrecking and Salvage Corps, excluding divers	+	50C

MASONS ..... + 10B
MASSEURS (not bath attendants) ..... + 10A
MECHANICAL ENGINEERS (not in mines) 0A
MECHANICS (if no special hazard) ..... + 10A
MERCHANTS (if no special hazard) 0A
MESSENGERS (See specific occupation.)
METAL TRADES AND INDUSTRIES.
Shop Work on Metal, Brass, Copper, etc.
Assemblers ..... +15A to + 50C
Buffers, Burnishers, Finishers, and Polishers ..... + 30B
Cutters and Grinders (dry process) ..... + 75C
Cutters and Grinders (wet process) ..... + 30B
Die Sinkers ..... + 15A
File Makers ..... + 75C
Gold-beater ..... + 15A
Nickel-plater ..... + 15A
Tinsmith ..... + 15A
Hot Iron and Steel Industry.
Blast Furnaces and Rolling Mill Employees—
Foremen, Assistant Foremen, Working Superintendent, and Sand Core Makers ..... + 15B
Annealers, Catchers, Doublers, Matchers, Pair Heaters, Rollers, Roughers, Shearsmen, Template Makers in Bridge Works and Cranesmen ..... +20BD
Casters, Forgemen, Foundrymen, Moulders, Mixers, Open Hearthworkers, Puddlers, and Steel Melters ..... + 30B
Hot Iron and Steel Workers making small pieces for stoves, autos, etc. ..... + 20B
Sheet Iron Workers.
Boiler Makers ..... + 15C
Bolt Headers, Clippers, Fence-weavers, Japanners ..... + 15B
Filers ..... +30B to + 70C
Tin-plate Mills.
Dippers, Picklers, and Tinners ..... + 60C
Other skilled workmen ..... + 15B
MILK DEALERS.
Proprietors 0A
Journeymen and Drivers ..... +15BD
MILLERS.
Proprietors 0A
Journeymen ..... + 15B
MILLWRIGHT ..... + 10B
MILLINERS.
Proprietors ..... + 10A
Workers ..... + 20A

MINING INDUSTRY. (Applies to all minerals, whether Coal, Copper, Gold, Silver, etc.)	
Dredger.	
Laborers and Oilers	+ 40C
Winchmen	+ 15B
Underground Mines.	
Owners, Operators, Superintendents, and Mining Engineers who *rarely* enter the mines	+10AD
Owners, Operators, Superintendents, and Mining Engineers who *occasionally* enter the mines	+ 30B
Owners, Operators, Superintendents, and Mining Engineers who *frequently* enter mines	+ 50C
Government Inspectors, and "Safety First" Inspectors	+ 30B
Bosses, Foremen, and Overseers	+ 70C
Electricians and Hoisting Engineers	+ 70C
Ore Samplers	+ 70C
Miners and Fire Boss	+ 100C
Gas Tester and Gas Watchman	+ 100C
Teamsters, Motormen, and Track Layers	+ 100C
Connected with Underground Mines, but whose duties are solely on the surface.	
Blacksmiths, Carpenters, Engineers (Donkey), Foremen, Firemen, Ore Sorters, Skilled Workmen, Tipplemen, Tool Dressers, Weigh-Boss	+ 30B
Hoisting and Surface Engineers	+ 15B
Surface Mines.	
Owners, Operators, and Superintendents	+10AD
Placer and Hydraulic Miners, Steam Shovel Engineers, and Cranesmen	+ 30B
Laborers, Switchmen, and Switch-tenders	+ 50C
MILLS AND CONCENTRATORS.	
Asbestos Mills and Mines.	
Superintendents and Office Men who *do not go* into the mill or mine	0A
Superintendents and Office Men who *occasionally* go into mill or mine	+ 15A
Superintendents and Office Men who *frequently* go into mill or mine	+ 40B
Foremen	+ 40B
Skilled Workmen	+ 60C
Unskilled Workmen	+ 75C
Assayer of Ore	0A
Concentrators—Wet Process.	
No Cyanide of Mercury.	
Superintendents, Foremen, Skilled Workmen, Engineers	+ 15B
Laborers	+ 50C

MILLS AND CONCENTRATORS.—*Continued*
Concentrators—Wet Process.—Continued
Cyanide of Mercury.
Superintendents ..... + 15B
Foremen, Engineers, Skilled Workmen ..... + 40B
Laborers ..... + 75C
Dry Process.
Superintendents ..... + 40C
Foremen and Engineers ..... + 60C
Mill Workers ..... + 100C
Corundum Mill.
Superintendents and Managers 0A
Foremen ..... + 10A
Skilled Employees—Men ..... + 15A
Skilled Employees—Women ..... + 30A
Lead Concentrate Mills.
Foremen, Skilled Workmen, and Engineers ..... + 60C
Smelters.
Managers and Superintendents ..... + 15B
Blacksmiths, Carpenters, Engineers, and Machinists ..... + 15B
Foremen ..... + 35B
Skilled Workmen ..... + 50C
Laborers ..... + 70C
Stamp Mill.
Managers and Superintendents ..... + 20A
Foremen ..... + 35B
Skilled Employees ..... + 50C
Unskilled Employees ..... + 70C
Zinc Mills.
Chambermen, Tablemen, Levermen, Zincmen, and makers of zinc sulphate ..... + 30C
Chiselers, Condenser Boys, Kiln Firemen, Loomers, Motormen, Ore Wheelers, and Poker-men and makers of zinc oxide ..... + 40C
Chargers and mixers ..... + 50C
Crushers ..... + 60C
Acidmen and pumpers in concentrators ..... + 75C
MINISTERS—See Clergymen.
MIRROR MAKERS ..... + 55C
MISSIONARIES.
In United States and Canada ..... − 10A
In foreign countries—no credit for occupation ..... +Habitat
MONOTYPERS ..... + 15A
MOSAIC SETTERS ..... + 10A

MUSICIANS.
- Where liquor is served..... +15A to + 50A
- In high-class orchestras..... 0A
- Others..... + 5A
- Organists..... 0A

N

NAVY (U. S.)
- Chaplains..... + 10C
- Commissioned Officers (excluding aviators)..... + 40C
- Hospital Stewards, Coxswains, Yeoman, Boatswain, Quartermaster, Machinist (Warrant), Gun Captain, Gunner's Mate..... + 60C
- Ordnance Men and Enlisted Men..... + 75C

Engine Room.
- Engineers (not officers)..... + 60C
- Mechanics aboard ship, including carpenters..... + 60C
- Firemen, Oilers, Water-tenders..... + 75C

Navy Yard.
- Civil Engineers—Civilian..... + 10A
- Clerks..... 0A

NEWSPAPER REPORTER..... 0A

NURSERYMEN..... − 10A
- Workers..... 0A

NURSES—In private practice..... + 10A
(See also "Asylums, Hospitals, and Sanitariums.")

O

OCULISTS..... − 5A

OFFICERS OF CORPORATIONS..... − 5A

OIL FIELDS.
- Superintendents and Managers..... + 5A
- Derrick Builders..... + 15B
- Cleaners, Floormen, Helpers, and Roustabouts..... + 20B
- Pipemen, Plumbers, and Stationary Engineers..... + 15A
- Riggers and Rig Builders..... + 40C
- Tool Sharpeners and Dressers..... + 15A
- Well Drillers, not using explosives..... + 15A
- Well Drillers, using explosives, and Oil Well Shooters..... + 80C

OIL REFINERY OPERATIVES..... + 15A

OIL TESTERS..... + 10A

OMNIBUS DRIVERS..... + 40C

OPTICAL INSTRUMENT MAKERS..... + 10A

OPTICIANS..... 0A

OSTEOPATHS..... + 10A

OYSTERMEN.

Proprietors and Captains..... 0A to + 20B
Employees..... +15A to + 40C

P

PAINTERS.

Carriage and Automobile..... + 10A
Ordinary..... + 15B
Bridge..... + 60C

PAPER HANGERS.

Proprietors..... + 5A
Foremen..... + 10B
Journeymen..... + 15B

PAPER AND PULP MILL.

(See Factory).

PATTERN MAKERS..... + 10A

PAVING LAYERS.

Skilled Workmen..... + 10A
Laborers..... + 40C

PAWNBROKERS.

Proprietors..... + 10A
Employees..... + 20A

PEDDLERS.

In Country..... + 10A
*In City..... +20A to + 50A

PHOSPHATE MILLS.

Employees, non-acid Fertilizers..... + 40C
Employees, acid Fertilizers..... + 75C

PHOTOGRAPHERS..... 0A to + 20A

PHYSICIANS.

Private..... + 10A
Roentgenologist (X-Ray)..... +15A to + 50C

PHYSICAL DIRECTORS..... 0A

PIANO TUNERS..... 0A

PIPE FITTERS..... + 10A

PLASTERERS..... + 10B

PLUMBERS, GAS AND STEAM FITTERS—Workmen..... + 10A

POLICE.

City Officials, Court Officers, Marshals, Officers, and Head Sheriffs with office duties only..... + 10A
Policemen, Detectives, Secret Service Men, and Constables + 35B
Motor-cycle Policemen..... + 35C
Marshals, Sheriffs, Deputy Sheriffs who make arrests..... +35C to + 100C
Railroad Detectives..... + 60C

*PORTERS—In Commercial Houses	+ 30B
(See also Liquor, Hotels, Railroad, etc.)	
POTTERS.	
Decorators, Dish Makers, Dressers, Finishers, Gilders, Hand-painters, Handlers, Jiggermen, Kiln Placers, Modelers, Moulders, Mould Makers, Pot Builders, Pressers, Printers, Sagger-makers, Stickers-up, Throwers, Turners, Warehousemen	+ 20A
Kiln Burners and Kiln Drawers	+ 40B
Dippers and Mixers	+ 80C
Spar and Flint Men	+ 200C
POWDER, MANUFACTURER OF—See Explosives.	
PRINTERS.	
Proprietors	0A
Proofreaders	+ 10A
Electroplaters, Electrotypers, Linotypers, Lithographers, Monotypers	+ 15A
PRISONS.	
Attendants and Wardens not exposed to special danger	+ 10A
Jailers, Prison Guards, and Turnkeys	+ 40B
Matrons	+ 15A to + 30B
PROMOTERS	+ 10A
PROOFREADERS	+ 10A
PUBLIC SERVICE—Peace.	
City, County, State, and General Government Officials and Clerical	0A
Custom-House Officials and Employees	0A
Letter Carriers	0A
PUBLISHERS.	
Proprietors	0A

Q

QUARRYMEN AND PITMEN—See Granite.

R

RAILROAD CLASS.

Baggagemaster (Station)	+ 10E
Baggagemen	+ 30C
Car Sealer	+ 30C
Clerical and Managerial	0A
Depot Master and Train Caller	+ 10E
Detective	+ 60C
Dining Car Stewards	+ 15E
Engineers—Locomotive	+ 60C
Firemen	+ 75C

RAILROAD CLASS.—*Continued*

Freight Brakemen—Automatic couplings	+ 75C
Freight Brakemen—Not automatic couplings	+ 100C
Freight or mixed train Conductors	+ 60C
Freight Handler	+ 50C
Mail Clerks and Express Messengers	+ 15E
Motormen driving electrical engines on railroad lines	+ 60C
Newsmen on trains	+ 40C
Passenger Brakemen or Trainmen	+ 30C
Passenger Conductor	+ 15E
Pullman Car Conductor	+ 15E
Pullman Car Porter	+ 75C
Pumpman	+ 40C
Station Agent	+ 10E
Telegrapher in large Stations	+ 10A
Train Despatcher	+ 20D
Construction and Maintenance.	
Bridge Builders, Carpenters, and Painters	+ 60C
Bridge Tender	+ 60C
Bridge Foremen	+ 60C
Construction Foremen	+ 60C
Cranesmen	+ 60C
Roadmaster	+10A to + 40C
Steam Shovel Engineers	+ 60C
Wreckers—Foremen	+ 60C
Wreckers—Men	+ 80C
Rolling Stock.	
Car Cleaner	+ 60C
Car and Air Brake Inspector	+ 30C
Car Repairer—Outside	+ 30C
Check Clerks	+ 30C
Coal Heaver	+ 75C
Crew Call Boy	+ 60C
Freight Inspector	+ 30C
Mechanics in Shops	+ 10B
Round House.	
Engine Hostlers, Wipers, and Flue Cleaners	+ 75C
Foremen	+ 30C
Repair Men and Machinists	+ 40C
Yard and Track.	
Batteryman	+ 60C
Flagmen and Gatemen—at crossing	+ 60C
Signal and Switchmen—from tower	+ 20E
Signal and Switchmen—not from tower	+ 100C
Signal Maintainer—Road	+ 60C

RAILROAD CLASS.—*Continued*		
Yard and Truck.—Continued		
Track Master or Foremen	+	60C
Track Section-hand	+	75C
Train Master	+	30C
Yard Clerk	+	30C
Yard Master	+	30C
Yard Foreman	+	60C
Yard Signal Repairman	+	75C
Yard Lampman	+	75C
Yard Switchman	+	100C
Yard Switch Repairers	+	75C
Elevated and Subway R. R. Service.		
Conductors, Guards, and Motormen	+	15B
Foremen of Maintenance	+	60C
Painters and Repairmen	+	60C
Signalmen	+	50C
Ticket Agent, Gatemen, and Ticket Chopper	+	20A
Track Walker	+	100C
Street R. R. Cable and Trolley.		
Conductors and Motormen	+	15B
Flagmen and Switchmen	+	30C
RANCHMEN.		
Proprietors	−	15A
Employees		0A
REAL ESTATE DEALERS		0A
REPORTERS—Newspaper		0A
REVENUE CUTTERS—See Coast Guard.		
RIDING MASTER	+	10B
RUBBERS IN TURKISH BATHS	+	30A
*RUG REPAIRERS	+	30D

S

SALESMEN—Unless hazard is involved		0A
SAW FILERS—Automatic machines	+	30B
Not using automatic machines	+	70C
SAW MILL.		
Proprietors		0A
Foremen and Engineers	+	5B
Skilled Employees and Firemen	+	15B
Laborers	+	40C
SCULPTORS		0A
SEAMSTRESSES—See Dressmakers.		
SETTLEMENT WORKERS		0A

SERVANTS.
*Butlers and Valets ..... +15A to + 30A
*Domestic and Hotel ..... +15A to + 30A
(See also Hotel and Liquor.)

SHIP BUILDING.
Blacksmiths, Carpenters, Coppersmiths, Electricians, Joiners, Loftsman, Pattern makers, Pipe-fitters, and Tinsmiths, Wood Calkers on steel ships (no work on scaffolding) .... + 15B
Bolters-up, Chippers, Holders-on, Riveters, Ship-fitters, Steel Calkers, no work on scaffolding ..... + 40B
Bolters-up, Chippers, Holders-on, Riveters, Ship-fitters, Steel Calkers, who work on scaffolding ..... + 60C
Riggers ..... + 75C

SEXTONS ..... + 10A

SHOEMAKER (Cobbler) ..... + 15A

SIGN PAINTERS.
Shop work only ..... + 15A
On scaffold ..... +20B to + 75C

SILK MILL EMPLOYEES—See Factories.

SOFT DRINKS.

SOFT DRINKS (Bottlers of Mineral Water and Soft Drinks).
Proprietors ..... + 10A
Canvassers, Collectors, and Deliverymen visiting liquor trade + 70A
Employees who use masks ..... + 40C
All others ..... + 20A
See also Drivers.

SPICE PACKERS ..... + 50C

STABLEMEN ..... + 50C

STEAMFITTERS, not on Railroads or in Mines ..... + 10A

STEAMSHOVEL ENGINEERS AND FIREMEN, not in Railroads or Mines +20BD

STENOGRAPHERS—Men or Women 0A

STEVEDORES.
Overseers ..... + 20A
Employees ..... + 50C

STONE WORKERS. (See also Granite and Marble.)
Cutters and Letterers ..... + 50C
Polishers ..... + 20B

STORAGE BATTERY WORKERS ..... + 40C

STREET CLEANERS ..... + 40C

STRUCTURAL IRON WORKERS—See Buildings.

STUDENTS 0A

SUBMARINE OPERATORS ..... + 200C

SUBWAY RAILWAY EMPLOYEES—See Railroad Class.

SUGAR REFINERY.
Superintendents, Managers.
Foremen 15B
Skilled Employees ..... + 40B

SUPERINTENDENTS—Non-hazardous occupations 0A
SURGEONS ..... + 10A
SURGICAL INSTRUMENT MAKERS ..... + 10A
SURVEYORS ..... − 5A

T

TAILORS.
Merchants 0A
Journeymen ..... + 15A
TANNERY EMPLOYEES—See Factory.
TAXIDERMIST ..... + 10A
TEA TASTER ..... + 25D
TEACHERS—School ..... − 10A
TEAMSTERS AND TRUCKMEN.
Proprietors ..... + 15A
*Men ..... + 40B
TELEGRAPH OPERATORS—Not Railroad 0A
TELEPHONE OPERATORS 0A
TERRA-COTTA WORKERS—See Pottery.
THEATRICAL CLASS—See Amusements.
TILE LAYERS ..... + 10A
TILE MAKERS—See Brick or Pottery.
TIN PLATE MILLS—See Metal Trades.
TOBACCONIST ..... + 10A
TOOL MAKERS—Not Grinders, light work ..... + 15A
TRAPPERS—Animals ..... 0A to + 50C
TRAINERS—Circus.
Animals—Wild ..... R. N. A.
Elephants ..... R. N. A.
Horses ..... + 50C
TRAVELING SALESMEN—Unless hazard is involved 0A
TUNNEL AND SUBWAY CONSTRUCTION.
Where no compressed air is used.
Civil Engineers and Superintendents ..... + 30B
Foremen and Skilled Mechanics ..... + 40C
Workmen—without blasting ..... + 50C
Workmen—with blasting ..... +75C to + 100C
Where compressed air is used.
Civil Engineers and Superintendents—
Who do not go in air locks ..... + 30B
Who occasionally go in air locks ..... + 75C
Foremen and Skilled Mechanics—
Who occasionally go in air locks ..... + 100C
Who do not go in air locks ..... + 40C
Workers in Caisson ..... R. N. A.

TURKISH BATH RUBBERS..... + 30A
TURPENTINE.
Stills—
Managers, Owners, and Superintendents..... + 15A
Workmen..... R. N. A.
Woods-riders..... + 40B
TYPE FOUNDERS..... + 15A

U

UNDERTAKERS.
Proprietors..... 0A
Employees..... + 15A
UPHOLSTERERS.
Proprietors..... 0A
Journeymen..... + 15A

V

*VALETS..... +15A to + 30A
VARNISH MAKERS, SKILLED WORKMEN..... + 20A
VETERINARY SURGEON..... + 10B

W

WATCH REPAIRER..... + 10A
WATCHMEN.
Day, if first-class..... + 25A
Night, ordinary..... + 40B
Night, if connected with Breweries, Railroads, or other special hazard..... + 75C
WELDERS, acetylene, electric, etc..... +10C to + 30C
WHITE LEAD WORKERS..... R. N. A.
WINDOW CLEANERS—See Buildings.
WIRELESS OPERATORS, on land..... + 10A
On ships—treat as Officers (see Marine).
WRITERS (Authors)..... − 5A
WELL DIGGERS—Old Fashioned..... + 150C
(See also Gas and Oil Wells.)
WHETSTONE CUTTER..... + 15A

X

X-RAY OPERATORS..... +15A to + 50C

Z

ZINC INDUSTRY—See Mining Industry.

Mr. Foshay—This paper by Mr. Hunter and Dr. Rogers, as the previous one upon medical selection, is an obviously candid effort to determine the development of life insurance selection toward uniformity. From the viewpoint of agency men the aim of these papers appears attractive. Once all companies select risks on one standard, the soliciting agent will have nothing to gain by shopping from one company to another with his border-line applicants. The selecting officers also in such an era would have, no doubt, a rather more comfortable billet.

Progress, however, comes by variations, not through uniformity. Biologic problems—of which one is life insurance selection—are inherently variable. I see no hope that at any future period longevity will be susceptible of *exact* mathematic analysis. To my mind, therefore, the variables of the problem in hand necessitate for their present relatively secure analysis the application to them of trained intelligences rather than of mechanical systems, no matter how perfect. Herein lies, I think, one of the advantages of disconformity. Wrestling with variables, there is need for scientific experiment to determine the relative value of different modes of treatment. Therein lies the advantage in our present state of knowledge of each company trying out novel methods.

In the Mutual Life our occupational selection has developed more and more toward individualism, and, I believe, with success. With us individualism applies both to the risks and to home office mechanism. To us each risk is a human being entitled to insurance at a rate that does justice to his peculiar and personal attributes and relations. In the Home Office we have favored and encouraged the development of industrial specialists, educated to study and understand the actual working conditions of particular trades. This involves the admittedly slow process of first securing and training the proper personnel, and then the time-consuming investigation of special trades, but ensures in the course of time scientific evaluation of industrial hazards.

Not unnaturally it therefore follows that to us the numerical

rating method as applied to occupational selection appears rather reactionary. The system seems to be built as a machine for purely mechanical selection. The effort apparently is to produce a method by which a person wholly untrained in industrial selection can correctly underwrite a life insurance risk from that standpoint. Such a method in dealing with one of the greatest fields of life insurance study would seem to be unfair to the individual applicant, subversive of the best interests of life insurance as an institution, and wholly neglectful of a great opportunity for effort toward industrial betterment. We believe that occupational selection can—and ought to be—made one of the active factors in the evolution of modern industrialism toward safety, longevity, and happiness. This cannot be done if we are content to accept the mortality ratios of past experience and to apply them in mass action upon whole classes of industrialized human beings.

If life insurance risks are being selected by underwriters personally familiar with industrial hazards through experience and study, the present modern condition of the industry will be more thoroughly recognized than if the sole knowledge possessed is from past experience, which, to be adequate, must cover a number of years when it is likely to be obsolete. It should be the duty of an underwriter passing upon industrial questions to know the trend of conditions in an industry so that he may not only be able to act upon the risk on the basis of what mortality has been experienced, but to make a fair assumption as to what the mortality will be within the next ten years. Whereas some idea along these lines may be had from the sources of information (exclusive of the insurance experience) mentioned in Mr. Hunter's and Dr. Rogers' paper, these are in the main so fragmentary and so many of them are produced from a standpoint so wholly alien to life insurance that the result, if sole dependence be placed upon them, is considerably short of what we would consider a proper foundation upon which to select risks. Scientific pamphlets of industrial hazards are, as a general rule, written in scareheads. For the scientific investigator, the existence of an industrial disease

or an industrial hazard is sufficient for an unlimited investigation, the greater part of which is useless for life insurance purposes. There is no occupation so dangerous or unhealthy that it may not be improved; and, in a great many instances, the hazards can be entirely eradicated. It should be the duty of a life insurance underwriter to know the present status of conditions in such industries and just what precautions should be taken.

In fairness to the individual applicant, the conditions surrounding his own place of employment should be considered as affecting the basis on which he is admitted as a member of the Company to which he is applying. The authors of the paper under discussion have mentioned the manufacture of electric storage batteries as in the category of unhealthy circumstances of employment. It may be as well, therefore, to take this occupation as an example of the point in question. It has been stated that the hazard in this industry comes from fumes of chemicals. The great hazard in the storage battery manufacture, however, is in the handling of the lead. There are storage battery factories, however, in the United States that are so equipped with mechanical devices for mixing the lead oxides and elimination of dust, so scientifically arranged as to the isolation of dangerous processes, and with sanitary facilities and rules of operation so devised and carried out that these factories are practically as safe to work in as an office. Conditions such as these should in fairness to the individual risk be recognized; and it is obvious that a purely mechanical system will fall short of doing so.

It may, of course, be stated in opposition that one cannot be sure that an operative insured in such a factory will remain in it. That is possibly true in isolated individual cases. It has, however, been noted in innumerable cases that there is so close a relationship between labor overturn and working conditions that one may almost be said to be an index of the other. When you find a factory with a huge labor turnover you may be certain that you are going to find bad working conditions. Industrial drift is, therefore, from the bad to the good, and not from the good to the bad. In other words, the selection in

industrial classes is working in our favor rather than against us. It is obvious, therefore, that if a life insurance company is going to do its full duty toward an individual applicant, that applicant's petition for membership should be passed on (if he is in a dangerous or unhealthy trade) by a skilled underwriter conversant with the details of the trade, and full information should be procured as to the conditions existing in his industrial environment. In passing, it will be noticed that there are occupations quoted in the schedule which accompanies Mr. Hunter's and Dr. Rogers's paper in which a latitude for selection is given. This latitude, however, is wholly individual and deals solely with the personal duties of the applicant and has no relation to his industrial environment.

Where possible, the effort of an insurance company should be the betterment of conditions. It has been proven by the wonderful work done by accident and health companies that insurance can exert a remarkable influence on industrial conditions. Conservation of industrial man-power is undoubtedly a paramount problem at the present time, and if life insurance can exert an influence in that direction it is too big an institution to neglect such an opportunity. It is not possible to realize fully on this opportunity with a mechanical system of selection which does not train the underwriter in the actual fundamental knowledge necessary for a scientific selection of a risk from the industrial standpoint.

Taking up now the application of our theories, the great points to aim at in the selection of a life insurance risk industrially are two:

First: Complete justice to the individual applicant. In order to attain this, four factors must be thoroughly considered:

A. The inherently dangerous or unhealthy nature of the trade he is in.
B. Applicant's personal exposure to the danger of his trade.
C. Applicant's particular industrial environment, or the actual conditions in the factory or shop in which he is employed.

D. Applicant's own mental stature, or his likelihood to understand and guard against the danger of his employment.

Second: A prompt recognition on the part of life insurance as an institution of all efforts that are being made toward the betterment of industrial conditions; such recognition not to wait until the entire industry shows the effect of such movement, but to be recognized and compensated for in all individual instances where it actually occurs.

To meet the requirements of these two aims of industrial selection several conditions must be present in the underwriting office of the company selecting the risk.

First, properly selected and trained underwriters must be assigned to the duty.

Second, a complete library of information must be maintained and sufficient research work done continually so that the office is kept alive to all varying industrial conditions.

Third, a sufficiently malleable system of rating must be in use to permit the proper compensation for favorable conditions.

Fourth, an information procuring system which will enable the company to determine without loss of time the industrial environmental conditions surrounding the particular risk.

As to the first of these factors, it is obvious that an underwriter to measure up to the requirements of this system, must be of sufficient scientific training to be able thoroughly to understand industrial processes and the nature and effects of industrial poisonings. Having picked your underwriter, his training should proceed along these lines, both by study of the special subjects in which he is to deal and actual field inspections of manufacturing hazards and conditions. This, of course, requires a higher type and higher salaried man than one whose only duty is to operate mechanically under a fixed system. This, however, is compensated for by the fact that these will constitute a very small part of the general underwriting office; will conduct practically all the industrial research work; will also take charge of other special lines of

selection which involve sanitary and health conditions in foreign countries; and, in short, all the specialized branches of lay underwriting.

Second, this condition speaks for itself and needs no comment.

Third, there are a great many systems for applying industrial extra premiums which will allow for varying conditions. The method which our own company employs at the present time is simply the quoting of two, or possibly three, extras to be given in preferred, semi-preferred, or ordinary cases. This system is probably not as scientifically accurate as some, but it has the advantage of being easily handled by the soliciting agent, and is, without doubt, sufficiently accurate to work out satisfactorily in the mass of cases. There is no doubt but what a better system can, and will be in time, devised and adopted. Very probably the system of increase in mortality used by a number of companies is better from a purely scientific standpoint. The main factor from the standpoint of the underwriter is the ability to recognize the individual conditions of each risk.

As to the fourth factor, this is, of course, done very largely by a complete system of occupation blanks which bring out the conditions in the factory which the underwriter must know. These blanks must be prepared by one of the specialized underwriters having thorough knowledge of conditions necessary to minimize the adverse factors in any industry. This will take care of the greater number of cases. As supplementary to this, a properly organized inspection force such as is fast becoming an absolute necessity to every properly operating life insurance company can quickly ascertain facts that are omitted from the data on the case when it is received. This, of course, may slightly delay an individual application, but if it is done for the purpose of giving the risk a preferred rate, the delay is just; and, in any event, it happens only in a very small minority of cases. Such a system as roughly outlined is impossible to operate under any method of purely mechanical selection. Nor are the two systems capable of working side by

side, as it is immediately apparent that the specialized underwriter who passes upon the case must in his analysis of it simply throw out the original rating that has been given it and start from his own standpoints. The net result, therefore, of having such a rating would be for application to the very worst cases and this is instantly accomplished by the maximum extra. In many instances it would also lead to the mechanical rating of numbers of risks without the application of the scientific principle which we regard as essential to proper industrial selection.

As to the factor of an absolutely even selection, we do not think that this is endangered by any method which aims at scientific and correct results. There are occasionally cases in which one man will receive a preferred rate, and another a higher, and conditions appear to be equal. This happens very seldom, and in the majority of such cases some factor has been overlooked by the person making the appeal, which changes the case's whole complexion. Of course, in an extremely rare instance it will happen that there is such diversity of action, but this is so rare that it should not operate against the system as a whole.

The convictions and methods thus hastily outlined represent the evolution of occupational selection in the Mutual Life. That future changes, at least in details, are inevitable we fully believe; but we are firm in the conclusion that in general our methods approximate that fairness and certainty in occupational selection which we regard as scientific.

From year to year we watch the trend of our mortality experience in those occupational classes in which the risks are sufficiently numerous. There is not time to record them in detail in this discussion. From 1907 to 1914, exposures through 1915, however, we experienced a mortality in the occupations classed as "hazardous" in the Medico-Actuarial Investigation of 114% of the expected by lives and 89% by amounts. The greater proportion of these are insured under extra premiums. In the "semi-hazardous" class of the Medico-Actuarial Investigation for the same period we registered a

mortality of 92% by lives and 94% by amounts—a good proportion of these being extra-premium classes.

As a final conclusion of our experience we are convinced that successful occupational selection—in fact all selection—is relatively simple provided the exact facts of insurability regarding each risk are at hand. The careful and minute job-analysis of each trade or industry by a skilled industrial expert enables the underwriter to classify his applicant accurately through the occupation blanks designed to draw out the specific information that is required. This, as already noted, must be supplemented by an inspection personnel carefully educated to check off the statements of the applicant. Local inspection reporters are trained to know the subdivisions of work in the industries of their vicinity and are thus prepared to clear up doubts of an individual applicant's occupation promptly and with certainty.

While thus in frankly setting forth the principles of our own action I have been compelled to take a different position from Mr. Hunter and Dr. Rogers, I have great respect for the pioneer work they have done. Time may prove their method the better, though I do not believe so. While we are confident that we are on the correct path, we make no pretense to finality but are constantly searching for and trying out new methods.

Mr. Murphy—This paper is one of great practical usefulness and we are all again indebted to the authors for a contribution that will assist in solving our common problems. Studies of the influence of occupation upon our business have not in general been as extensively made as they have been in the casualty field where occupation affords the primary means of classifying risks. The fact that medical examinations and inspections have given us powerful guides in the selection of risks has perhaps tended to diminish the attention paid to occupation. I believe this to have been particularly true in cases where the occupation was not sufficient in itself to disqualify for standard rates.

It has been my experience that one of the great problems in selection is the accurate and consistent measurement of risks

which have two or more unfavorable features, any one of which is not sufficient to cause rejection at standard rates. This problem is faced by every company whether conducting a sub-standard business or not, and therefore this paper is of general usefulness by its inclusion of virtually all occupations. There is apt to be a tendency, particularly on the part of agents, to consider a risk satisfactory unless there is some one sufficiently important impairment to cause rejection or a sub-standard offer. This seems to me an improper view, but unless we have a pretty definite conception of the effect of minor impairments in the risk, we are in danger of acting in such a manner.

Another practical problem which confronts those charged with the responsibility of selection is the interpretation of particular cases in occupations requiring extra premiums. It may be urged that the factory in which the applicant works is an unusually healthful one for such a business or that, for example, a certain theatrical man is so superior in his tastes and mode of life as to warrant removal from the threatrical class of risks. If we admit that each risk should be selected on its merits some of these pleas may appear to be well founded.

This emphasizes the importance of subdividing occupational ratings in such a way that each classification will be reasonably homogeneous. If this has been done, exceptional treatment will not generally be warranted. It must further be remembered that if the rating is based on an experience which included the more favorable types of the occupation, that rating will probably be insufficient after excluding such favorable cases. On the other hand, it is necessary to consider changes in ratings from time to time in any occupational group, the risks of whose employment have been altered by new methods in the industry. In addition there are great practical difficulties in obtaining homogeneous classes in occupations where the extra mortality arises from moral environment and we are sometimes justified in treating distinctly favorable cases leniently. This requires on the other hand that the ratings for the group be placed high enough to warrant the exclusion of exceptionally good cases.

The introduction of disability and double indemnity benefits in life insurance policies has brought up new problems in the art of selection. Just as we are obliged to classify life risks with care so that anti-selection may not render the premiums inadequate, so I think we shall all agree that the only proper way to handle these new benefits is to grant them or refuse them in accordance with the rates of loss to be expected under each benefit from the class of risks to which the individual belongs. In classifying risks for double indemnity and disability, occupation plays a very important part, and the symbols showing the authors' opinions in this respect are especially valuable.

It is probably too early to obtain a satisfactory volume of experience indicating the rate of disability and of mortality among the disabled for the various occupational classifications. We may feel somewhat more confident about the rate of accidental death because of the information to be obtained from previous mortality experiences which show the causes of death. It is the part of wisdom, however, to asume that the number of accidental deaths reported under policies containing no double indemnity clause is less than the number that would have been reported if such a clause had been included. I do not mean to imply that we must expect fraudulent claims, but rather that certain deaths primarily due to accident may have been reported in the past as due to an intervening traumatic disease. In view of the lack of data in all companies under both the disability and double indemnity clauses, the occupational classifications suggested by the authors from their wide experience in handling questions of selection are particularly welcome.

It will be noted that the paper does not go further than to say whether the authors would accept or refuse each clause because of occupation. It will also be seen that in certain occupations requiring sub-standard life rates they would issue such benefits. It would be of interest to know what rates would be charged in such cases. It seems to be a conviction among accident and health underwriters that lives physically impaired are subject to an accidental death rate somewhat

higher than the normal because of their lack of recuperative power in event of accident. It is also reasonable to assume that lives sub-standard for occupational and other reasons will exhibit some extra loss under disability benefits. The question therefore arises whether in sub-standard occupations, which do not seem to affect disability and accidental deaths directly, we should expect something above normal losses because of the larger number of lives which will become physically impaired.

If extra losses are to be expected, then some method should be found to assess extra premiums. If a company rates up the age to cover extra mortality and the disability and double indemnity rates are charged for the higher age there would appear to be no direct connection between the rates and the risk. This may not be a very important fact in the present undeveloped state of the subject. It would, however, have the very peculiar effect of reducing the rate for general accident double indemnity on limited payment life forms, if the rates for double indemnity are based on a constant premium for all ages at issue on the ordinary life plan, as is done in some companies.

With the desire to have a simple and yet flexible method by which each clause could be charged for in accordance with the merits of each class of risks, and independent of the life rates, the Equitable adopted the practice of charging certain multiples of the regular rates for these benefits. As we do not charge extra life premiums for sub-standard business based on the method of rating up the age, there was no reason to follow that method with such clauses. This also permitted us to issue the benefits with proper multiple rates for some of the occupations in which the authors advise rejection. I speak of this because any list such as the authors have given will partly depend upon the method of premium charges which the particular company uses.

Dr. Dublin—We in the Metropolitan have also recently completed a revision of our Occupation Rating List. I hope you have all received a copy.

The need for a fairly complete Occupation Rating List is probably greater in a Company like the Metropolitan than in most other companies that limit their writings, for the most part, to preferred risks. As you know, we do a very wide business, including Ordinary, Intermediate, and Industrial insurance. To a very considerable extent, our Intermediate and Ordinary business is built upon a foundation of Industrial policyholders. As Industrial policyholders insured with us as children grow up and improve their condition, many become eligible for Intermediate and Ordinary insurance. The fall in the value of money and the consequent rise of wages have also had a very marked effect in developing a demand for Ordinary insurance among working people. Please do not misunderstand me. The Company does a very large Standard and Super-Standard Ordinary business. But, in the nature of the case, it also writes a very large amount of Ordinary and Intermediate business on the lives of working men and women whose occupations often involve hazards. We are, therefore, careful in the inspection of risks for evidence of occupation hazards and have established a technical section for this purpose.

Our method of rating is somewhat different from that practiced by the New York Life. We rate by plan of insurance and not by rating up the age of the applicant. We recognize four distinct mortality tables. There is first our regular Ordinary insurance which is intended to cover Standard or Preferred risks. There is no room in this group for those exposed to any serious hazard of occupation. The second group includes the Intermediate risks who are working people able to pay premiums quarterly, annually or semi-annually. They are exposed to the average risks of industry and their expected mortality may run up to a limit of 150% of the American Experience Table. The third plan is on the Special Class Table and is intended for applicants where the hazard is more severe, the expected mortality being up to 200% of the American Experience. Finally, we have recently added a fourth group, Special Class B, in which the expected mortality runs up to

250% and includes a number of hazardous risks which were formerly declined.

It is not at all a simple matter to compare the ratings of our Company with those used by the New York Life. The mortality tables used by the two companies are quite different, and this difficulty is still further accentuated by the diverse nomenclature of occupations used by the two companies in their lists. It is unfortunate that life companies have not as yet agreed upon a working list of occupations which would be available to them all, even regardless of varieties of rating practice. To-day each company has a list which has grown up out of its own experience without much regard to the requirements of comparability or to the technical precision of the terms used. In the Metropolitan, the plan has been, wherever possible, to list the individual occupations under their respective industry class. In the list submitted by Mr. Hunter and Dr. Rogers one finds the individual occupations more often singled out for individual consideration. There is perhaps an advantage in following the industrial arrangement more consistently because, in this way, the agent soon learns to know the relative hazards in the several occupations of one indstury. Industries are often identified with certain localities; as, for example, tire making in Akron, automobile manufacturing in Detroit, etc. Agents in such locations should be encouraged to think in terms of their chief local industry and it is convenient for them to have the individual occupations listed under each other rather than alphabetically as separate occupation titles. We have found it useful to give a supplementary list of occupations arranged alphabetically without regard to industry; but this is considered subsidiary to the main industrial classification.

In general, the New York Life ratings and those of the Metropolitan are in close agreement. They have been constructed from very much the same sources. In both companies little reliable information of a statistical character on the mortality of occupations is available. The number of occupations where there has been a sufficiently large and recent exposure to be indicative of present industrial conditions, is very

small indeed. Much more useful has been the descriptive technological data published by departments of labor of the States and Federal Government, the reports of departments of mines, Factory Commissions, Workmen's Compensation Boards, and now and then, the reports of special investigations of industries by government commissions. We have used extensively the works on industrial chemistry, engineering, and general technology. Where necessary, we have made investigations of our own of plants in specific industries and have checked up our judgment with expert advice. Our data have always been tempered by underwriting judgment. In our Company, ratings have been somewhat determined also by investigations of occupational mortality in the large industrial experience and, also, by intensive investigation of individual claims where occupation has obviously played an important part in causing death. For a period of years, we have collected large numbers of records indicating that certain types of accident and of disease are associated with occupations. Such records are very suggestive of the type and gravity of the hazard which surround certain occupations. More recently, we have obtained guidance through the study of the experience of the Group Department. The data for a number of groups, covering a considerable number of industries, are now available. The results are exceedingly helpful as we have exact information with respect to exposure and the experienced deaths. The important point to remember, however, is that the ratings are rarely based upon an actual mortality experience. It is important to emphasize this point because the rating lists of companies even that of the paper under discussion give the impression of having been based largely upon conclusive statistical data. Of course they are not.

As might be expected, there are some important differences in the ratings of occupations in the New York Life and Metropolitan lists. The former Company is very liberal indeed in rating workers in iron and steel mills, granting standard rates to virtually all occupations in the industry. The practice of the Metropolitan has recently been liberalized to grant Inter-

mediate insurance to the large number of workers who are moderately exposed to heat and to accidents in iron and steel mills. The most hazardous occupations, including those around Bessemer converters, the rollers, roughers in plate mills, puddlers, tongsmen, and heaters are granted Special Class insurance; a small number, like the pot lifters and the hand chargers and a few others, are limited to Special Class B insurance. It is difficult to understand on what grounds the more liberal New York Life ratings for these occupations were constructed. Our best reports show a mortality rate between one and two per 1000 from immediately fatal accidents in iron and steel mills. This figure is augmented by deaths which occur later from disabling accidents. The exposure to heat and to hard work and long hours must add appreciably to the total in deaths from neumonia, heart disease, and the other degenerative conditions. We have recently liberalized our ratings for commissioned officers of the Army and Navy, except Aviation officers, to whom we issue Ordinary insurance (except Whole Life or Term policies) without Disability Annuity or Double Indemnity provision and with a war clause. The New York Life rates commissioned officers up 40% which is apparently equivalent to six years additional. We are also more liberal in our ratings of policemen. On the other hand, the New York Life List is more liberal with fishermen, longshoremen, and stevedores, woodsmen and rivermen and linotypers, monotypers, and electrotypers. It would be very difficult and perhaps fruitless in this place to present a parallel list of all the differences. Any one who is interested can make the comparison between the two lists.

With reference to Disability Annuity and Double Indemnity provisions, the lists of the two companies agree fairly closely, although the methods of procedure are somewhat different. In the Metropolitan, Disability Annuities are granted to Ordinary and Intermediate applicants with practically no exceptions. We do not, at present, consider it necessary to restrict those occupations where a higher rate from tuberculosis or disabling accidents may be expected. Those who are

exposed to severe hazards, like the Special Class risks, cannot obtain Disability Annuities. In like manner, the Double Indemnity feature is limited to applicants granted Ordinary insurance with the exception of a small number of occupations where there is an accident hazard, but not in itself sufficient to limit to Intermediate insurance. In effect, the restrictions on these two policy provisions are much the same in the two institutions.

The whole tendency of occupation rating at present is in the direction of greater liberality. Such a policy is largely justified by the constantly improving conditions of industry. The development of the "Safety First" movement; of industrial medicine, surgery, and sanitation; the extension of workmen's compensation by States, and the establishment of departments of labor exercising supervision over factories; the increasing power of labor unions in their insistence on better working conditions; all of these have brought about remarkable improvements in the conditions surrounding labor. The ratings of companies have tried to keep pace with these improvements. Many more changes will have to be made to do justice to workers in what were formerly hazardous occupations. Altogether, companies are ever ready to liberalize their rates under the pressure of the sales department of the business. It is amusing to observe how soon after one company liberalizes its rate, whether rightly or wrongly, how many of the others soon follow suit. I consider this bad policy but it happens only too often under present underwriting conditions.

In conclusion, may I not recommend that a Committee representing the Medical Directors, the actuaries and the insurance statisticians engaged in occupation rating work, be organized to prepare a uniform nomenclature for use by insurance companies. Such a committee could also outline a plan of office practice which companies could employ in determining their occupation ratings. If desired, the committee could even proceed with the preparation of adequate ratings based not only on such statistical evidence as may be available and worthwhile but, more especially, upon a knowledge of current

conditions in industry. Provision should be made for the ready exchange of information between companies which will lead to more uniform ratings in the future. No single Company can possibly succeed in working out this immense problem. For one thing, the services of technicians in the several industries and students of industrial hygiene will have to be consulted to obtain more adequate descriptions of processes and the hazards to health that are encountered. The expense of such effort can best be borne by the several companies contributing to the plan on some equitable basis. We should all feel very humble in the face of the huge problem involved in preparing a rating list for occupations which shall be at once fair to applicants for insurance and to the underwriting companies. The whole subject is in its infancy and it is most inadvisable for any Company to believe that its present methods or results are final.

Dr. FitzGerald—I have read with interest the paper of Dr. Rogers and Mr. Hunter, and in order to be able to discuss it intelligently I have communicated very freely with Dr. Frederick L. Hoffman, Vice President and Statistician of The Prudential Insurance Company.

It is most difficult to discuss a paper which presents the subject of occupational rating in its relation to life insurance from a viewpoint of a company the methods of which are widely at variance with those generally adopted. For a full understanding it would be necessary to have much more information as to both the methods and the results of the New York Life's experience which, as far as I know, are not available. If the ratings are based entirely upon the medico actuarial experience, it may be said that that experience in many particulars is open to serious doubt as to the conclusiveness of the data in their application to present day rating problems. The methods of The Prudential are based in all cases upon the Company's actual experience carefully observed for many years and practically down to date, supplemented on the one hand by statistical information derived from general experience, and on the other by thorough personal investigations

into existing industrial conditions with a due regard to occupational subdivisions, so as to locate the true occupational hazard in consequence of a higher accident liability or an increased liability to disease. The Prudential limits itself to three occupational ratings. Occupations which cannot be brought within these three groups are declined, but only upon individual consideration with a due regard to all the facts available to Company at the time.

The practice of the New York Life in rating an occupational case a number of years ahead has, as far as we know, been adopted by few other companies. The danger involved in the practice was best illustrated in the recent anthracite wage dispute in which it was charged that miners were rated sixteen years above the actual age and were therefore assumed to be subject to a curtailed longevity of an equal amount. Our experience conclusively proves that statistics alone cannot solve the problem, but that there is required a thorough knowledge of the conditions which give rise to occupational hazards in particular industries.

Dr. Rogers and Mr. Hunter in their conclusions observe that it is to be hoped that "As a result of the publication of our statistics the practice of other companies will be given so that we may add to our knowledge of occupational mortality," but they give no statistics of experience, but only a statement of the rating methods followed by their company. This, it is to be assumed, is merely an approximation and not to be accepted as a statement of actual experience. A few illustrations will make this point clear.

Under theatrical employees, actors, book agents, and box office employees are rated alike, it being intimated that they are subject to an extra mortality of 40%. This, we believe, cannot be shown, for we believe no statistical evidence can be supplied for this statement. Why box office employees or actors should be subject to an extra mortality of 40% we are unable to understand. In contrast it may be pointed out moving picture actors, who are certainly subject to a much higher hazard than ordinary theatrical employees, are rated

at 40%, subject only to modifications in the plan of insurance.

It has never been the practice of our Company to discriminate in the case of ordinary employments subject to but a slight increased occupational hazard, such, for illustration, as bakers are apparently rated on the assumption of an increased mortality from 10 to 30%, and barbers, who are assumed to be subject to a higher death rate of 15%. It would be interesting to know what statistical evidence the company can furnish that would justify occupational discrimination in the case of skilled trades of this kind.

The list, of course, is entirely too long to be gone over in full detail, but attention may be directed to the excess in rating of 75% in the mortality of workmen in cement works. As far as we are informed, all of the investigations which have been made have shown the comparative harmlessness of cement dust as a factor in lung fibrosis or tuberculosis. By way of contrast unskilled workmen employed as concrete block makers are subject to an excessive mortality of 40%, although for all practical purposes probably subject to much the same degree of dust exposure.

A curious statement is with reference to professional gamblers, which, as far as our knowledge goes, are declined by all companies because of the fact that this is clearly unlawful employment. It is implied that the excessive mortality is from 50 to 90% and the absence of the R. N. A. would seem to imply further that these are not considered in the class of risks not considered acceptable.

Under stone workers, granite cutters are referred to only as work with the chisel. The most important occupation in granite cutting is work with pneumatic tools which unquestionably and seriously predispose to lung fibrosis. The classification does not in our judgment represent actual occupational consideration at the present time. The same conclusion applies to marble workers and to slate workers. Marble workers are subject to a lesser disease liability than granite workers on account of the obviously less injurious qualities of the dust.

We are at a loss to understand what is meant by longshore-

men employees. This class of labor, at least in the past, was generally undesirable for ordinary insurance on account of the very heavy labor and the liability to overstrain and the very casual nature of the employment.

The mining classification does not seem to us to conform to modern methods. The recent anthracite coal controversy has brought out the fact that all companies may consider it advisable to revise their rates so as to discriminate with a higher degree of scientific accuracy the different branches of the mining industry. For it would seem unscientific to classify coal miners not subject to miners' phthisis in the same way as quartz miners of the western states, particularly those employed in the zinc and lead mines of Missouri and the deep lead mines of Montana, but in any event it would seem unscientific to classify miners and fire bosses alike since the latter are unquestionably subject to a higher occupational hazard. It also would seem contrary to experience to classify government mine inspectors and safety first inspectors in the mining industry on the assumption of a higher mortality of 30% when the serious accident risk is practically limited as an insurance factor to men employed in mine risk work of the more hazardous kind. In the case of safety engineers the same rule seems to apply as in mine engineers. Documentary knowledge secured and experience offset the inherent accident liability in the mining industry.

The foregoing are but a few illustrations of the controversial aspects of a question which has received entirely inadequate consideration on the part of the medical directors charged, as in the case of most companies, with the responsible duty of assessing extra premiums on account of occupational hazards. In the case of The Prudential this duty has for many years fallen upon the Statistician's Department, which is required to report a statement of fact and specific recommendation in each and every case open to doubt and not subject to the regular rules and regulations as contained in the manual. That office amplifies all its inquiries with a large amount of data, practically up to date, concerning every dangerous or unhealthy

employment. In the light of a long experience we are satisfied that our practice is satisfactory alike to the insured as well as to the Company.

Dr. Rogers and Mr. Hunter—In his discussion of our paper Dr. Fitzgerald makes the statement that "It is difficult to discuss a paper which presents the subject of occupational rating in its relation to life insurance from a viewpoint of a company the methods of which are widely at variance with those generally adopted." We cannot understand Dr. Fitzgerald's difficulty because, while it is true that we have for years followed the numerical method of selection of risks, it is not true that this method produces results essentially different from the empirical method in use in other companies, for the reason that the underlying facts upon which the two methods are based are practically the same. We find it difficult to reconcile Dr. Fitzgerald's statement with that of Mr. Little of his own company, who in a discussion of this same paper before the Actuarial Society of America, said that it ". . . represents a further contribution from the company which, from its officers, has done perhaps more than any other to shed light on the difficult subject of scientific assessment of sub-standard risks." We are especially surprised to learn from Dr. Fitzgerald that "the methods of the Prudential are based in all cases upon the company's actual experience carefully observed for many years and practically up-to-date" for the reason that there are a great many occupations which come before us on which we have no actual mortality experience. In this respect we find ourselves in the same position that Dr. Dublin of the Metropolitan Life occupies who frankly states that with reference to his company "little reliable information of a statistical character on the mortality by occupations is available." The New York Life does not base its practice on statistics alone, nor have we ever said that it did. The Company always takes into consideration the changing conditions in so far as it is able to do so.

Surely Dr. Fitzgerald cannot be serious in his suggestion that there is a danger involved in the advance in age method as

against the special class or extra premium method of providing for increase in mortality, because in a wage dispute it was assumed that an advance of 16 years in age meant a curtailed longevity of equal amount!

In regard to theatrical employees, Dr. Fitzgerald must have forgotten the results of the Medico-Actuarial Investigation, or otherwise he would have understood our practice of rating these cases. The statement that moving picture actors "are certainly subject to much higher hazard" is at variance with the conclusion arrived at by one expert well qualified to speak on the subject, as shown in the Transactions of the Association in Volume V, page 123 *et seq.* Dr. Fitzgerald in his discussion has selected certain occupations and criticized the ratings thereon, but he has selected for his criticism occupations on which we have practically no reliable data because so few engaged in these occupations have ever applied to us. We thought we had distinctly stated that in many of such occupations the mortality was determined "from the similarity to other occupations whose ratios are known." He makes the statement that professional gamblers are denied insurance by all companies. This is not so, as several companies, at least two of considerable prominence, accept them with an extra premium. We do not see any reason why a company which is willing to insure anthracite coal miners with an advance in age or an extra premium should refuse insurance to longshoremen.

All discussions on the subject of extra mortality on substandard risks are very welcome and it is natural that the representatives of a company conducting a very large industrial business should be in a position to speak with authority with reference to the effect of certain occupations on mortality, and we hope that Dr. Fitzgerald will not content himself with assuring us that we are wrong in some of our ratings but will instead add to the sum total of insurance knowledge by detailing for our information the true facts in each case.

Dr. Foshay's discussion of our paper should be placed in the hands of every selector of risks because it is both instructive

and scholarly. He is evidently a master of the subject of occupation, and his judgment of the bearing of occupational hazards in the selection of risks must be of great value to the company which he serves. But in his plea for greater individualism in selection we cannot follow him, nor do we appreciate the weight of his arguments. The old method of selection was an "individual" method in that it rested upon the judgment of the individual unaided by definitely formulated standards, and, to our minds, therein lay its weakness. In his own company he has "encouraged the development of industrial specialists, educated to study and understand the actual working conditions of particular trades," and by so doing he is training persons to think, not on general principals, but on concrete facts. That Livery Stable Proprietors for example show as a class a mortality of about 125% must be one of the very first facts regarding that particular occupation that he must teach his specialists, and no doubt it must be upon that fact that he builds up his training of them as to that occupation. Starting with that fact as a foundation, his students must come presently to recognize that just as some of them are doing business under conditions more favorable than the average, so, on the other hand, there are others, applicants for insurance, whose surroundings and circumstances of business and of life are worse than the average, and in assigning a plan of insurance to individual risks they must distinguish between the better and the worse and grant plans of insurance more or less favorable according to the merits of each case. This is not individualism, this is scientific selection, guided, and, as we think, assisted by the basic fact of an underlying mortality of 125%.

We have nowhere intended to convey the thought that each numerical value is a rigid and invariable thing. It may very well be that in our earlier publications we have not laid sufficient emphasis upon that phase of the operation of the system. On the contrary, we who employ the Numerical System look upon each of the basic ratings as but a center, at or on either side of which the value of the factor it represents may be found. Because the numerical rating of a Livery Stable

Proprietor is +25, it by no means follows that the particular case which Mr. Foshay is passing judgment upon is of that value. He may find very good reason in the circumstances of the case to decide that it shall be +10 or 50. Even so, we venture to believe that the knowledge that these people as a class show a mortality of 125% must help him, as it does us, in the formation of his final judgment of an individual case.

It is this use of the Numerical Method, as a steadying influence, as a central guide, that is its principal value. There is nothing mechanical about the Numerical System excepting that, in the routine selection of risks those which are clearly standard or super-standard are mechanically separated from those which require the more painstaking analysis of experts like Mr. Foshay.

We are very much pleased to learn from Dr. Dublin that "in general, the New York Life ratings and those of the Metropolitan are in close agreement." He points out a number of differences of opinion when over 200 occupations were contained in our list. In many of these there are not sufficient statistical evidence at hand and naturally the mortality ratings were determined by studying the conditions under which they were carried on and comparing them with those of other occupations about which our knowledge was more exact. In such cases a difference of opinion will always exist and also in those where changing conditions call for modifications of the company's experience, taking account of recent improvements. It might be interesting to note that the difference between the practice of the Metropolitan and the New York Life in several of the outdoor occupations seems to be due to our belief that that method of living is a partial offset to the accident hazard.

Dr. Dublin's suggestion that a committee be formed to prepare a uniform nomenclature for occupations is most timely.

We are indebted to all those who have prepared discussions on this paper.

Dr. Weisse—The next paper is of particular interest, as it is a paper on a medical question, presented

by an Actuary, "Is the Average the Same as the Normal for Weight and Blood Pressure?" by Mr. Arthur Hunter. We will have it discussed by an Actuary as well as by members of the Association. Mr. Wendell M. Strong, Associate Actuary of the Mutual Life Insurance Company, will open the discussion.

IS THE "AVERAGE" THE SAME AS THE "NORMAL" FOR WEIGHT AND BLOOD PRESSURE?

By Arthur Hunter

Chief Actuary, New York Life Insurance Co.

It may seem unusual for a layman to discuss a subject which apparently trespasses on the medical domain, but actuaries are frequently consulted now-a-days in connection with medical statistics. Witness the report for the Mayo Clinic on duodenal and gastric ulcer, and the joint investigation by the Actuarial Society and the Association of Life Insurance Medical Directors, into the mortality among men with functional heart murmur, or with intermittent albuminuria. My remarks will be from the standpoint of one who is called upon to consider medical matters more or less from the statistical standpoint.

WEIGHT

In general conversation it will be noted that the same construction is frequently placed upon "average" and "normal." If for example, the average weight of 10,000 men of 5 ft. 8 in. at age 35 is 155 pounds, we usually assume that this is the normal weight. It may be the normal weight if these men are living under normal or natural conditions. It is necessary therefore to have clearly in mind the difference between "average" and

"normal" in considering the subject of weight. For the purpose of this brief paper, "Normal" may be defined as that which is according to the standard observed in Nature, while "Average" may be defined as the "calculated mean of several quantities" under natural, normal, or abnormal conditions. The mathematical definitions are not under discussion at this time.

In Volume II of the report on the Medico-Actuarial Mortality Investigation, the Committee shows that the lowest mortality at the youngest ages of entry was among persons slightly above the average weight; while at the older ages of entry it was among persons decidedly under the average weight. The following table, taken from the more recent report of the joint committee, "Standard Mortality Ratios Incident to Variation in Height and Weight among Men," indicates the mortality at the lowest point.

TABLE SHOWING THE POINTS OF LOWEST MORTALITY ACCORDING TO VARIATIONS FROM THE AVERAGE WEIGHT—MEN OF MEDIUM HEIGHT

Ages at Entry	Percentage Variation	Number of Lbs. Variation
20–24	+5 to +10	+10 lbs.
30–34	0	0 to + 5 "
40–44	0 to − 5	0 to −10 "
50–53	− 5 to −20	−10 to −35 lbs.
60–62	−10 to −25	−15 to −40 lbs.

If we were to consider the point of lowest mortality as the normal weight, then such weight does not increase with advancing age. Thus, the *average* weight of a man 5 ft. 8½ in. in height increases from 156 lbs. at age 32 to 165 lbs. at age 52; whereas the *normal* weight, if the point of lowest mortality is considered the normal weight, decreases from 158 lbs. to 142 lbs. A table is given showing this in more detail.

NORMAL WEIGHT CONSIDERING POINT OF LOWEST MORTALITY AS NORMAL WEIGHT—MEDIUM-SIZED MEN AVERAGING 5 FT. 8½ INCHES

Age Group	*Normal Weight*
20–24	158 lbs.
25–29	158 "
30–34	158 "
35–39	157 "
40–44	157 "
45–49	154 "
50–53	142 "
54–56	140 "
57–60	138 "

Several reasons may be suggested to account for the increase in weight with advancing age in the case of the average individual under present conditions:

1st. The more abundant and richer food which many men are enabled to obtain in middle life through a substantial increase in their incomes;

2nd. The more concentrated and refined foods which are obtainable to a greater extent in this generation than heretofore, and the needlessly high percentage of proteins in the food of well-to-do persons;

3rd. The inability of men as they grow older to "burn up" the excess food which they eat;

4th. The tendency to seek bodily comfort as one grows older, and to decrease the amount of exercise or work.

Under primitive conditions it is likely that as a man grew older his weight would not increase, because he would either have to work harder in order to obtain the necessary food for sustenance or to eat less. Whatever the cause, it seems reasonable to believe that the increase in weight with advancing age is an abnormal and not a normal condition. I confess that my attitude in this matter has changed since the report on the mortality according to weight was published by the Joint Committee of the Actuarial Society and the Medical Directors' Association. I did not then object to the phrase "pounds

under or over normal weight" when the number of pounds departure from the average weight was meant.

Another reason for suggesting that the average weight may not be the normal weight lies in the difference between the average weight of men of different nationalities. In Vol. I of the Report on the Medico-Actuarial Mortality Investigation it is stated that the average weight of the German insured is about 10% higher than that of the insured in the United States and Canada. "The smaller the stature of the German the more does he exceed in average weight the American." On the other hand, the average weight of the Japanese is less than that of the American or Canadian for the same height and age. Again, recent statistics published in Britain show that at the principal heights and insuring ages, the average weight is nearly the same in Britain as in the United States among insured lives. The average weight reflects the racial stock, the methods of life, the climate, and other conditions. It is likely that the normal weight of entirely different races, such as the Nordic and the Mongolian, would show a marked divergence, but in countries in which the inhabitants come from practically the same stock, is the difference in build not due to abnormal living conditions?

A few words may be said regarding the normal weight as developed by Professor Georges Dreyer of Oxford University, England. He states that his formulæ are based on "the analysis of a number of observations sufficient to ensure a degree of accuracy that should prove entirely satisfactory"; that they may require to be changed slightly, but not sufficiently "to impair their present validity from the practical point of view."

In determining the normal weight Professor Dreyer takes account of two factors:

First, length of the trunk, *i. e.*, the height sitting.

Second, circumference of the chest at rest.

In life insurance practice the ***average*** weight is determined from the height and the age, but the ***normal*** weight is determined by Professor Dreyer from the length of the trunk and the circumference of the chest. He finds that age is of little

or no importance "up to an age of about fifty years," and this is in line with the preceding table, when the normal weight is defined as the point of lowest mortality.

By means of formulae and tables given in "The Assessment of Physical Fitness" the normal weight of an individual of the observed trunk length and chest circumference may be obtained. This normal weight is then compared with the actual weight, and the percentage deviation from the former is then determined.

The foregoing method has been brought too recently to my attention to enable me to make a test of it and compare the findings with those under our present practice.

BLOOD PRESSURE

By a study of 67,000 cases, Dr. Rogers and I confirmed previous tables with regard to the average blood pressure of persons accepted for insurance as standard risks. Our table showed the following:

SYSTOLIC BLOOD PRESSURE

Age	*Men*	*Women*
15–19	120	117
20–24	122	118
25–29	123	119
30–34	124	121
35–39	125	123
40–44	127	125
45–49	129	128
50–54	133	132
55–59	134	134

This table shows a gradual increase of the average blood pressure, but is this normal, or is this increase *partly* due to our abnormal way of living? With increase in age must come some deterioration of the arteries, but does the foregoing table show a greater increase than the true normal? A physician at the head of a great sanitarium told me that the blood pressure should remain nearly stationary after maturity, and that

our concentrated food and lack of rational exercise, were the real causes for the marked increase with age. He based his opinion on the fact that in hundreds of cases coming under his observation the systolic blood pressure did not increase above 120 in the case of middle-aged men who had limited their consumption of proteins as they had grown older. There have come under my own observation a number of instances of vegetarians and of persons who have lived on a "low" diet with a blood pressure of 110 to 115 mm. although over 50 years of age.

These statements raise the question—Is the lowest mortality represented by the group of insured lives with average blood pressure? Unfortunately, we have no satisfactory way of determining this, as we had in the case of weight, because sufficient experience has not yet been developed to show the mortality among persons with blood pressure distinctly below the average. The only statistics which have been published to my knowledge cover a small group with sixteen deaths in the Northwestern Mutual Life Insurance Company. These indicated that persons accepted by the Company with a systolic pressure of less than 106 mm. had a relative mortality below the average mortality of all the policyholders. This agrees with the general impression among medical directors and actuaries that a blood pressure of from 5 to 15 mm. below the average is an advantage rather than a disadvantage to the individual.

In our paper on "Blood Pressure as Affected by Sex, Weight, Climate, Altitude, Latitude, or by Abstinence from Alcoholic Beverages," Dr. Rogers and I show that the average blood pressure among overweight men is higher than among underweight men of the same age. Is this an indication that the average blood pressure is not normal blood pressure? The difficulty in answering this and similar questions proves that we need to make researches into the mortality among persons with blood pressure below the average, differentiating, if possible, between vegetarians and meat eaters. Lest there be a misunderstanding, I wish to add that in writing this note

there was no expectation on my part of answering definitely the question raised by the title, and that my purpose is to stimulate thought on the problem, and to suggest a line of scientific research which may prove fruitful.

Mr. Strong—Mr. Hunter has questioned whether "Normal" should not be used to describe best weight rather than average weight and has given a table of best weights. It is this last that I am interested in—what is the best weight at the various ages—and this is what I shall discuss, limiting myself to medium height (5 ft. 7 in. to 5 ft. 10 in.). Mr. Hunter is to be thanked for bringing the question so definitely to the attention of the Society.

Mr. Hunter's results were based on the tables prepared by the Medico-Actuarial Committee under the title "Standard Mortality Ratios Incident to Variations in Height and Weight among Men." These tables were principally from the data of the Medico-Actuarial Investigation but the Committee also made use of the statistics of the Mutual Life experience which I shall mention later. Tables I and II of these tables show closely where the best weight in the opinion of the Committee lies for ages up to 50. For ages above that a number of the five-pound weight groups give the same mortality so that a weight in any one of these groups might be selected as best weight; or even the whole range of the groups showing the same mortality might be taken as the field of best weight; for instance, ages 54 and upwards all show the same mortality for weights from 122 pounds to 152 pounds. Mr. Hunter has chosen to drop to 142 pounds for ages 50 to 53 and to lower weight for higher ages. I regret to differ from him here in that it seems to me a weight a number of pounds higher should be taken. My reasons are as follows: Up to a comparatively few years ago there was the feeling that a considerable degree of underweight as compared with the average weight was an impairment, so that a man 40 pounds under the average weight, that is at ages over 50, weighing about 124 pounds, at height 5 ft. 8½ inches, would have had to have been in other respects exceptionally good to have been accepted as a standard risk,

and the same would be true in a lesser degree for thirty-five pounds, thirty pounds, or even a less number of pounds underweight. Hence, I believe that if the standard of selection for the underweights had in regard to other things than weight been the same as for average weight, or near average weight, a higher mortality would have been shown for the extreme underweights. This would have tended to the choice of a higher weight among those showing in the table the same mortality as the best weight. For this reason, I should choose a weight considerably higher than Mr. Hunter has for the best weight for ages at entry over 50. Another reason is that whatever the particular experience shows, a drop of 12 pounds between two adjoining age groups is unreasonable. For these adjoining groups the mortality of the younger group with the exception of the first few years, covers the same years of age as that of the older group. In other words, they largely cover the same period of life. Hence, unless there is some peculiar mortality in the first years of the younger age group, or some decided tendency to change in weight during the few years dividing the two groups, there should be no great difference between two adjacent groups.

Through the courtesy of Dr. Symonds, I have had the use of the original data of the Mutual Life referred to above, being the issues of 1885 to 1906 inclusive, exposed to the anniversary in 1915, and from these I have drawn the conclusions shown later. In so doing I have not been able to give the refinements of discounting the value of all deaths back to year of entry and of taking account of reserves as the Committee did in its preparation of the Standard Mortality Ratios.

Two principal difficulties presented themselves in getting results. One was that the division into weights was by Build Groups of the Medico-Actuarial Investigation, such groups having a range of about 15 pounds, so that the problem usually consisted in finding at what point within a given group the minimum mortality would occur. The other was that notwithstanding the large amount of data, nearly 32,000 deaths for the men of medium height, there were great irregularities.

Using the five central build groups, I plotted the mortality curve for each build group, the points of this curve being by quinquennial ages up to 50, from there on groups of ten years and nine years being taken. After inspection of these curves, it seemed that most of the irregularities which looked as if they were incidental would be eliminated by taking ten-year groups instead of five, that is, 20–29, etc. Using the mortality thus obtained, weight curves were plotted for quinquennial groups of ages up to 50, through the five known points. From these the point of minimum mortality was determined and thus tentative results obtained. These results, however, being upon the summation of actual and expected deaths of the whole experience necessarily gave too great influence to the early years of duration, since twenty-two years of entry were included in each of the first nine years of duration, while but one year of entry was included in the thirtieth year. A modified table had, however, been prepared by dividing the actual and expected for each year of duration by the number of years entry included, thus bringing all to a similar basis. A comparison with this table led in some cases to a slight modification of the tentative figures. This together with the consideration relating to light-weights which I mentioned in connection with Mr. Hunter's figures, gave the table below, except for ages 20–24. For these ages, an exceptionally low mortality in build group one may or may not have been an accident. In view of the effect that weight seems to have at these young ages as a defense against tuberculosis, it seemed that this probably was not wholly accidental. On the other hand, the data in the Mutual Life experience were taken largely from a period when the means of communicating tuberculosis were not understood and guarded against as now, and when a diagnosis of tuberculosis was a sentence of death. Hence, it seemed on the whole better not to give too much weight to the very low mortality for this one group since even, if not wholly accidental, it represented the past and not the present. My final result was the following table of best weight for height 5 ft. 8½ inches, as derived from this experience.

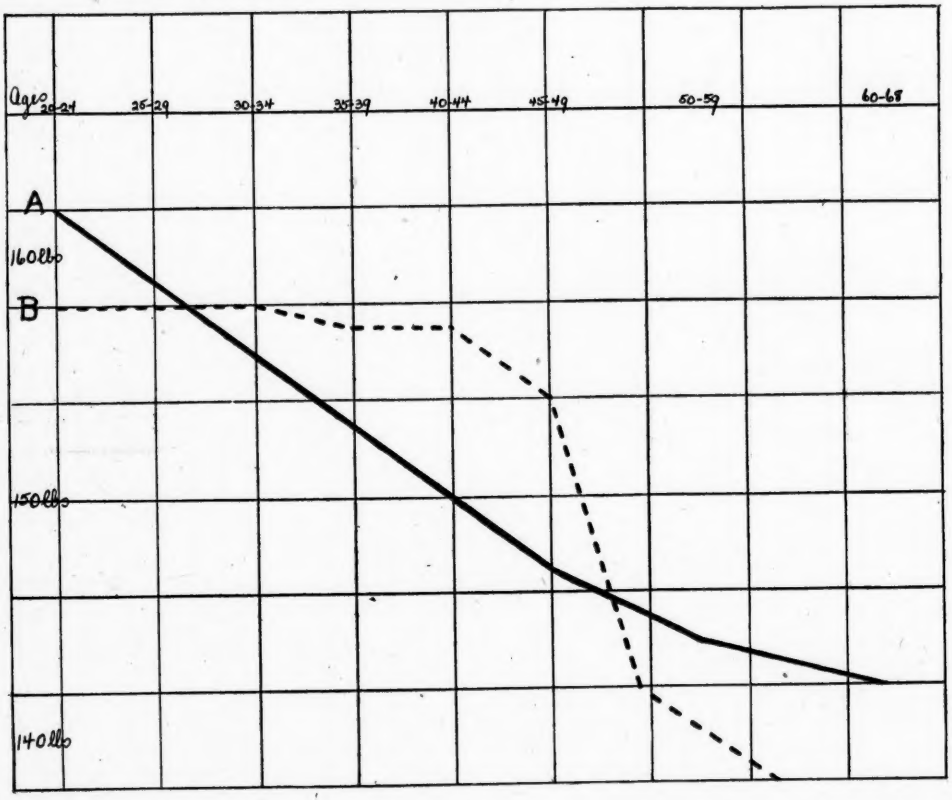
Ages	*Best Weight*
20–24	162
25–29	159
30–34	156
35–39	153
40–44	150
45–49	147
50–59	144
60–68	142

The following graph shows the two "best weight" curves; that from the above table being marked A and Mr. Hunter's being the dotted line marked B.

In thus giving a table of best weight we are marking out a line as the best. I do not think the statistics fully justify this: A band not very wide at the younger ages and growing wider with age would probably be better; for how can we say that 159 lbs. is better than either 158 or 160 lbs. at ages 25–29? If we attempt to define the limits of such a band, however, our difficulties are even greater than in determining a line; hence, we may interpret the line if it is the correct one, as showing the weights which with those for a little distance on either side are the best.

Having determined the table of best weight, it behooves us to consider what it means. For the table derived from the "Standard Mortality Ratios" the word "best" is definite since the data were adjusted to refer to insurance and ordinary life insurance at that.

On the one hand, the data used for the above table were larger proportionately for the first nine years of exposure than for later years; on the other hand, expected and actual mortality in any year of exposure were taken at the full amount instead of being discounted back by interest to value at entry and no account was taken of reserves. The two opposite influences would, to some extent, perhaps pretty fully, counterbalance each other, so that the results may not be greatly different from what they would had it been possible to apply the greater refinements used by the Committee. Furthermore, it must be remembered that the reducing the influence of the earlier years of duration to have all durations correspond to


Ages
20-24
25-29
30-34
35-39
40-44
45-49
50-59
60-68
A
160lbs
B
150lbs
140lbs

the same number of years of entry is equivalent to reducing the extent of the experience and increasing the effect of accidental variations.

It is not improbable that "best weight" is variable rather than a constant; we have seen above how our recently attained knowledge of tuberculosis may have changed the best weight for the younger ages from what it was a few years ago, and also how a change in selection might influence it where such weight seemed to run much below the average.

Dr. Brandreth Symonds, Chief Medical Director of the Mutual Life, has made a table of "best weight" from the same data using an entirely independent method. His results throughout the entire table differ but slightly from those above.

Dr. Symonds—Mr. President and Gentlemen: A year ago I was studying the influence of weight in my own Company. The number of deaths in each of these Build-groups, 6, 0, and 1 was very large, amounting in many age-periods to over 1000 for the height-group 5 ft. 7 to 5 ft. 10, the average of which is 5 ft. 8½. Even in the shorter and taller height-groups, the number of deaths amounted to several hundred in many of the age-periods. The height-group of shorter men comprises 5 ft. 3 in. to 5 ft. 6 in., and the average is 5 ft. 5 in. The taller men comprise 5 ft. 11 in. to 6 ft. 2 in. and the average is 6 ft. To determine the exact weight of lowest mortality was not easy for each build-group covers 13 to 18 pounds. After the build-groups had been adjusted, the weight of lowest mortality was estimated to be as follows:

Age	*5 ft. 5 in.*	*5 ft. 8½ in.*	*6 ft.*
20–24	143 pounds	163 pounds	189 pounds
25–29	141 "	160 "	180 "
30–34	139 "	157 "	177 "
35–39	137 "	154 "	174 "
40–49	130 "	147 "	165 "
50–59	129 "	145 "	162 "
60 & over	128 "	142 "	159 "

The following table shows the deviation from the average weight for each age-period.

Age	*5 ft. 5 in.*	*5 ft. 8½ in.*	*6 ft.*
20–24	+ 8	+15	+26
25–29	+ 3	+ 8	+11
30–34	− 2	+ 1	+ 3
35–39	− 7	− 4½	− 4
40–49	−17	−15½	−17
50–59	−20	−22½	−25

In the age period 20–24, it will be noticed that the deviations from average weight are very large, and there is a slight deviation in the next period 25–29. From 30 to 34 they are nearly coincident, but after that they slightly increase though with a minus sign.

The above figures are based upon the years of issue 1885–1906 in the Mutual Life, exposed to 1915. I am very glad that Mr. Strong, using the same mortality ratios, has arrived at a result very similar in regard to the men of medium height, 5ft. 7 in. to 5 ft. 10 in. though by an entirely different method.

A question to be determined is whether normal weight should be based upon 30 years of exposure exclusively as shown in the above table. We all know that among men of 50 and upwards the lighter weights show distinctly a lower mortality and this becomes even more noticeable above 60. On the other hand these same light-weights suffer more severely, probably from tuberculosis, in the ages below 30. Should we not therefore attach a little more significance to the earlier policy years—say ten—when the policyholders are more numerous and the reserve is very small? Would not the "man in the street" feel that his best weight for the next ten years meant more to him than for the twenty years thereafter? Laying only a little stress on this and taking also the unadjusted mortality-ratios for these Build-groups the weight of lowest mortality is set forth in this table.

Age	*Weight*
20–24	169 pounds
25–29	167 "
30–34	165 "
35–39	163 "
40–44	150 "
45–49	152 "
50–59	150 "
60 & over	137 "

In the above table the moderate over-weights have very much the advantage down to age 40. It seems as if the overweight was a real antidote to tuberculosis. After age 40 this danger seems to disappear quite rapidly and probably the risks of over-eating and generous living begin to increase. After age 60 it certainly looks as if the lean and slippered pantaloon had much the best of it.

Dr. Fisher—The average blood pressure is based upon risks that have been accepted by several companies—the Northwestern, the Mutual Benefit and the Prudential, making some 60,000 readings, and recently the New York Life has furnished us with something like 67,000 readings. No doubt we have taken a number of risks with a higher blood pressure than we will take in the future, so that our average, especially for the older ages, is undoubtedly too high. Now with the first twelve thousand blood pressure readings taken by the Northwestern, we were laboring under difficulties by examiners using the 3½-inch cuff, 4-inch cuff and 5-inch cuff, and in getting up those averages I did not suppose it was going to be accurate, because we had to reduce those to what was afterwards adopted as the average width of the cuff, 4½ inches, and about three years after the uniform cuff had been adopted I thought I would go back and compare the results with the averages I had ascertained in our first investigation. About the time I made up my mind to do that, the Mutual Benefit came in with a large number of cases where there was not a variation of more than 1 mm. for any age, and shortly after that the Prudential came in with a large number, so that we had something like 50,000 blood pressure readings, as appears in the report of your com-

mittee in 1915, and which vary very little from that recently ascertained by the New York Life.

Mr. Hunter mentions that we have no statistics of mortalities of low blood pressures, which is very true. We had about 500 in our 1915 report. I do not know whether or not Mr. Hunter heard my remarks to-day, but we had something like 3400 where the blood pressure was 100 and under, and for the two years that they were exposed we had only a mortality of about one third of the M. A. Table, so that I think we will get our best mortalities at the lower blood pressure, considerably lower than what we had on the average blood pressure. I think my report this morning will give a very clear idea that about 15 mms. above the average of the systolic pressure by the palpatory method is the border line for above. For below, I am not prepared to say. It seems to me with an exposure of something like four years, with just about one third of the mortality expected, our best mortality is going to be at the lower figures.

Dr. L. F. MacKenzie (read by Dr. Patton)—Mr. Hunter, when closing the very interesting paper which is under discussion, makes the statement: "There was no expectation on my part of answering definitely the question raised by the title of the paper."

Thinking the matter over, with what care we have been able to exercise, it has seemed to us there is a very great deal of difference between the two. He defines "Average" as the "calculated mean of several quantities" and "Normal" as "according to the standard observed in nature" and further states "The mathematical definitions are not under discussion at this time." We suggest that the average as above defined is obtainable only through a mathematical process, when so obtained is of necessity a fixed quantity, and does not admit of variation when derived from a definite group. Average then lends itself to precise definition. We feel that the definition "According to the standard observed in nature" or any other we have seen, has not materially advanced our concept as to just what the normal is, for the reason that we are dealing with

a condition which is elastic and varies to a considerable extent within, what may be regarded as, physiological limits. Briefly our view point is that in our work average is mathematical while normal is physiological. A definition of normal is not attempted but we hope the foregoing indicates a very fundamental difference between the two.

We purpose leaving for discussion by others that portion of the paper devoted to weight but wish to comment briefly on the section dealing with blood pressure.

The author refers to the rise in blood pressure as age advances, and seems to raise the question as to whether this increase is normal, or really abnormal as the result of unfavorable factors of various kinds. Does the fact that many, well advanced in years, show pressures much lower than the averages established for those years indicate that normally an increase does not occur? We think not. It is well known that blood pressures in healthy children are lower than those in healthy adults. The increase in pressure seems due to developmental, structural, and functional changes which are very necessary and physiological. Should we expect this change to stop in an organism of ceaseless activity with its accompanying anabolic and katabolic processes, or, can we under such conditions limit the normal to a fixed quantity? As age advances we enter the field of physiological pathology. What may be looked on as physiological at fifty might well be pathological at twenty. Certain known changes occur, as age advances, which have a more or less direct effect on the circulatory system tending to raise arterial pressure. How early these begin and how rapidly they advance depends on the quality of material from which the body is developed (heredity), on the environment, and on the mode of life of the individual. That wide variations are possible, and, many of them entirely within physiological limits, seems evident. Low pressures may then in some be indicative of a circulatory system of more than ordinary powers of resistance to the usual wear and tear of life; the material from which it was constructed being of exceptionally good quality. We are convinced that low pressures in otherwise

healthy individuals advanced in years are of very favorable prognostic significance but do not necessarily indicate that the usual advance noted means pathological change beyond that which seems physiological for the attained age.

Were we to forecast on the question "Is the lowest mortality represented by the group of insured lives with average blood pressure" we would be inclined to say yes, all other circumstances being equal, for the reason that the average as obtained from selected cases is as close an approach to the normal mean as is possible.

Normal mean we understand to be the average of selected cases supposedly within physiological limits.

Study of the article has suggested to us something to which it does not allude, namely, the value of very close coöperation between the Actuarial and Medical Departments. The Actuary deals with averages and establishes the values of these by mortality investigations, while the Medical Director, being more intimately concerned with the normal, uses the averages and mortality ratios as guides to determine, in the light of medical knowledge, what departures from the averages fall within or without physiological limitations. Mortality ratios then become the ultimate test of medical selection. Each department it seems to us has its limitations and only by the heartiest coöperation between the two is it possible to obtain a thoroughly scientific selection.

Dr. Strathy—Mr. Chairman and Gentlemen, I have been interested in blood pressure for a great many years, in insurance work for only seven or eight years, but in clinical work for double that time. It seems to me that in considering low blood pressure we must take into account what we are dealing with. If we are dealing with a person in whom a low blood pressure is the pressure of health then the low blood pressure is a favorable thing. In dealing with men of all ages you will notice that people with easy going dispositions, who do not wear themselves out, usually run a low blood pressure, even up to old age; but on the other hand a low blood pressure may indicate the beginning of an illness such as tuberculosis. Therefore I think

that the question one must consider is, is the low pressure the natural pressure for that person, or is the low pressure associated with a defect such as tuberculosis and various debilitating diseases?

Mr. Hunter—I am very much indebted to Dr. Symonds, Dr. MacKenzie and Mr. Strong for their interesting discussions of my paper.

The Tables of "best weights" suggested by Dr. Symonds and Mr. Strong are more nearly in accordance with my own opinion at the younger ages than the table given in my paper. It is probable, however, that the decrease in the death rate from tuberculosis will result in a nearer approach to the best weights submitted by me. So far as the older ages are concerned, the best weight may be changed somewhat in the future, due to the decrease in the use of alcohol, the increase in surgical efficiency, and the increase in the knowledge with regard to diseases of the elderly.

SECOND DAY

President Weisse in chair. Meeting was called to order at 9.30 A.M.

The Secretary announced that he had cast a ballot as instructed for the candidates placed in nomination on the preceding day, and the following officers and members of the Executive Council were declared elected:

PRESIDENT

DR. AUGUSTUS S. KNIGHT

FIRST VICE-PRESIDENT

DR. THOMAS F. McMAHON

SECOND VICE-PRESIDENT

DR. FRANK L. GROSVENOR

SECRETARY

DR. ANGIER B. HOBBS

TREASURER

DR. CHARLES L. CHRISTIERNIN

EDITOR OF THE PROCEEDINGS

DR. ROBERT M. DALEY

EXECUTIVE COUNCIL

DR. GEORGE A. VAN WAGENEN
DR. EDWIN W. DWIGHT
DR. J. ALLEN PATTON

Dr. Weisse—Thanks to Dr. Grosvenor, the question of Group Insurance will make its bow in the Proceedings of this Association. I hope for a discussion on this paper by the representatives of all companies who engage in this particular line of insurance, and I also hope that the discussion will be full enough and free enough to be of interest and instruction to the companies who may wish to undertake this particular line of business.

GROUP INSURANCE—ITS MEDICAL ASPECTS

By F. L. Grosvenor, M.D.

Medical Director Travelers' Insurance Company

The evolutionary trend of Group Insurance having progressed along a course which has resulted in the practical elimination of individual selection, the subject matter legitimately within the scope of this paper is necessarily limited.

Group Insurance is defined by the New York State Statute as follows: "Group Life Insurance is hereby declared to be that form of Life Insurance covering not less than fifty employees with or without medical examination, written under a policy issued to the employer, the premium on which is to be paid by the employer or by the employer and employees jointly, and insuring only all of his employees, or all of any class or classes thereof determined by conditions pertaining to the employment, for amounts of insurance based upon some plan which will preclude individual selection, for the benefit of persons other than the employer; provided, however, that when the premium is to be paid by the employer and employee jointly and the benefits of the policy are offered to all eligible employees, not less than seventy-five per cent. of such employees may be so insured."

No fraternal organizations, benefit associations, or labor organizations as such can be insured under a Group Policy. This provision is a wise one from the medical standpoint, in that it prevents fraternal and benefit associations from which the better lives have lapsed and the remaining lives are largely impaired attempting to obtain coverage at low group rates. If, however, the contract can be made with the employer, the premium paid partly by the employer and partly by the employee and seventy-five per cent. of the eligible employees covered, a Group Policy can be written.

Statutory requirements necessitate medical examinations before Life Group Insurance can be issued in, at present, three states. Certain states which formerly had this requirement

recognizing that this law properly applies to individual Life Insurance and should not apply to Group Insurance have rescinded the requirement.

Small groups below fifty lives, termed by some companies Wholesale Insurance, may be issued upon short form examination at rates comparable but somewhat higher than those of Group Insurance, the rates being based on individual experience and expense rather than that of Group Insurance.

The wholesale risk must be selected as a group upon the general line of selection followed in the selection of group insurance, and in addition, care must be taken to see that an employer is not endeavoring to cover an undue number of poor lives. There is no opportunity for self-selection. The employees must necessarily be in physical condition permitting them to engage in their occupation and a modified physical examination is required. Impaired lives may be declined or rated and the additional individual premium adjusted into the total premium. It is thought that if large numbers of such small wholesale risks are obtained, making a wide distribution of risks, the result in mortality experience will approximate that in Group Life Insurance proper.

The trend away from medical examination and individual selection in group lives resulted from the difficulty in selecting lives without defeating the purpose of the employer, which is to provide protection to all employees on an equitable basis. The files in all companies writing such insurance contain, I expect, many instances of groups thoroughly considered at much labor and expense, in which the insurance was not placed because of this effect of an attempt at individual selection upon the purpose of the employer.

It became apparent that selection by groups could properly take the place of selection of individuals. An increase of rates at the older ages may be necessary to cover a tendency to misstatement of age in certain of the lower grades of risks. The inability of the physically defective to obtain employment and their consequent inability to enter within the contract, the inability to attempt self-selection, the great distribution of

exposure and the necessary consideration of the occupational hazard, whether that of accident or disease, have permitted the development of this line of insurance without increasing the mortality rate over that obtained among lives selected upon the basis of individual medical examination and inspection. It should be understood that those employees who become impaired to the extent of total and permanent disability while in the service of a group assured are taken care of under the total and permanent disability coverage of the group life contract.

Another factor tending to produce a satisfactory mortality is important, although not strictly medical, in that the bulk of group life insurance has been written upon the employees of concerns which are managed in the most intelligent and satisfactory manner as regards working conditions and character of employees. I believe that my statement will not be challenged when I say that the employers of this country who have purchased group insurance have as a class advanced beyond those who have not adopted this plan as regards improvement in relations between the workman and his employer. It is also true that employees who are insured under group policies show an effect of better working, living, and other conditions which is not apparent in those of an uninsured class.

The age exposure in Group Insurance differs considerably from that in individual life insurance, the maximum exposure of my company in its group business being at ages thirty to thirty-four years, while in its regular business it is from forty to forty-four years.

The conversion feature is a requirement under Group policies and the conversion clause is noted in the certificate which goes to the employer. Actuaries have predicted that the conversion feature will result in a very heavy mortality. Up to the present, experience has shown that the loss in conversions has not an appreciable effect upon the group mortality as a whole. Perhaps this again illustrates that insurance needs to be sold and that without the element of salesmanship even insurance without medical examination is not taken when

perhaps most needed by the individual. No commission is paid on conversions.

Opinion is decidedly adverse to unlevel insurance in which an employee may carry at his own expense an increased amount, since it places such an employee on an inequitable basis as compared with his fellow-employee and also permits self-selection unless safeguarded by medical examination.

An unsatisfactory experience is to be expected in risks written on a salary basis as to amount, in which the officers and older employees receive excess amounts, being at the same time the most likely to be impaired.

Serious objection is taken to plans of group insurance in which payment of the entire premium is not made by the employer, as it permits of self-selection and defeats the purpose of the employer, in that not all employees enter the group. Part payment by the employee is feasible only when practically all employees enter the group.

A group experience will be affected by the medical department of the company to the extent that that department influences: first, the group selection; second, conditions pertaining to the condition of the group after the insurance is in force.

In the selection of the group the medical officer should have information as regards the health conditions in connection with the plant, including its location, conditions in the community, information as to occupational disease hazard—occupations such as street-railway employees, for instance, giving decidedly increased mortality from tuberculosis—the general character of the employees as regards race and living conditions, the presence or nonexistence of disease-producing conditions, such as dust, chemical or other substances which produce untoward results. A diversified knowledge of production processes is necessary in order to avoid overlooking occupational disease hazards.

The group having been selected and the insurance being in force the importance of medical influence upon the experience in group life or accident and health insurance is not to be gain-

said, and this feature provides a great field for development by medical officers and sanitarians along the lines of preventive medicine which constitutes such an important factor in the welfare of the race.

Conditions in the plant, standards of living and sanitation among the employees may be improved with favorable effect upon mortality. Appreciation by both employees and employer of the importance of such measures is necessary. The means by which these may be attained are properly matters for medical development. Here the medical officer and the sanitarian can accomplish the most for the company, the employee, and the body politic.

Plants may be visited from time to time, suggestions made covering contingencies so numerous and so well known to the sanitary expert that it is not necessary to enumerate them and so practical that they are readily adopted with marked improvement in conditions. Addresses may be made before employees on hygiene, sanitation, living conditions, avoidance of infectious disease and of occupational disease hazards particularly as pertaining at the plant involved. Assistance may be rendered public-health officers in their attempts to control epidemics or to improve community or plant conditions. Pamphlets may be prepared for general distribution covering these and other factors in many and varied aspects and in a manner which, while not unprofessional, will permit of comprehension by laymen of ordinary intelligence.

The number of lives exposed in group insurance is so large that a tremendous field for statistical work is provided both as regards death claims and causes and particularly in accident and health group insurance tabulation as to the duration, etiology, distribution or geographical location of disabilities. The virulence of infections as affected by geographical location and efficiency of public-health measures may be studied and conclusions reached as in no other field except possibly that of European countries with government sickness and disability insurance.

My indebtedness to the authors in the bibliography given

below is acknowledged. The paucity of literature on the subject leads me to suggest a perusal of the same to those interested.

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Dr. Willard—Dr. Grosvenor has given us a very interesting paper and has fully and clearly described *group insurance* and *wholesale insurance*. His reference to the medical aspect of the subject it seems to me is a plea for the greater participation of the medical officer in the preparation of the various plans of group and disability insurance. As to the importance of the medical man in making selections, it has been said that if the group were large enough to contain the normal percentage of good and bad risks, that all companies could afford to issue policies without medical selection or, to put it another way, every man passing a given point during business hours in a large city, could be given a policy provided all received the same amount, this limitation being made to prevent the selection against the company by the consciously bad risks taking a larger amount than the average.

As regards wholesale insurance and very small groups, what Dr. Grosvenor says might readily be challenged by actuaries as well as medical directors and at any rate it is the custom with most companies issuing insurance of this kind, to subject very small groups to a short form of medical examination.

The experience of companies doing group and disability insurance has not been bad so far as mortality is concerned, but in the disability end of the business there is much uncertainty and in the consideration of claims arising thereunder it might well be urged that medical supervision and control be strengthened—human nature being what it is—there is constant opportunity for malingering and a careful but just supervision of claims must be exercised. There are many reasons, and practically all of them have been mentioned by Dr. Grosvenor, which justify the belief that a satisfactory mortality will be experienced by companies selling group insurance but not until our experience has been of a longer duration will we be able to adopt a more confident tone regarding the disability features of group insurance contracts.

Dr. Grosvenor says a group experience "will be affected by the medical department of the company to the extent that that department influences first the group selection, second, conditions pertaining to the condition of the group after the insurance is in force." As to the first the general knowledge required by the companies regarding the hazards of occupation, climatic conditions, environment of the working man, etc., are so generally known, or the information is available, that it is reasonably easy to estimate the hazard of mortality and all things being equal the services of the medical director are not particularly needed, but it is regarding the second heading that it seems to me much might be said. After the group has been accepted the company which issues the insurance has the opportunity, nay the duty, of keeping the conditions satisfactory or of improving them, if that is possible, and my company which has, as you know, been somewhat prominent in welfare service affairs and its policyholders and the general public, offers to those under group policies many services which it is believed will work for the good of the insured and the insurer. The nursing service which is so extensively employed among our Industrial policyholders, is given to those insured under group insurance and educational literature on very many subjects is freely distributed to those under the protection of

our policies; simple facts clothed in language easily understood are told concerning food, clothing, housing, accidents, common diseases, care of infants and many others. In fact its campaign of education of the general public has been conducted now for many years and we are allied to and we coöperate with all known agencies for the betterment of the condition of the working people of this country. Dr. Grosvenor's paragraph containing his suggestions might have been prepared after an inspection of the activities in which my company has been engaged for its policyholders, its employees and which it now gives to policyholders in the Group Life Department. In addition there is a Bureau of Service which offers assistance where it may be needed or is acceptable to the employers pointing out the possibility of making improvements in the conditions concerning the operation of plants whether large or small. This Bureau is constantly increasing its work and the experience which it gains in one section of the country is put at the service of the employer in a far remote one. With the passing of time and the handling of greater numbers it is not too much to hope that important and lasting results may be experienced in the matter of public health both by prevention of disease and by more and better care of those who become sick, in decreasing the loss which comes to the worker from enforced absence from work, by preventable sickness, in inculcating lessons of thrift and orderly habits among the workers and in bringing about a reciprocally clearer understanding of the rights and duties of employer and employee.

We all of us, I know, feel proud of the work in which we are engaged and it seems to me the duty is before us of increasing that pride by our active whole-hearted and sympathetic endeavor to make group insurance a thorough success, thereby increasing the health, happiness and prosperity of our people.

Dr. Wells—I have read the paper of Dr. Grosvenor with a great deal of interest. My remarks, however, will be brief and limited, because the paper, as you have observed, is broad and comprehensive, covering almost the entire subject of group insurance. It has been said, that this is wholesale insurance.

In the paper of Dr. Grosvenor's, you will find the legal definition of Group Insurance, as defined by the New York State statute. That definition was framed and constructed by the Actuarial Society, acting in conjunction with the Executives of various companies interested in this phase of the work, and the definition they have evolved is very clear and comprehensive.

There are one or two fundamental questions that often arise in connection with group insurance. First, the argument for its existence, as well as its object. As an illustration, take the case of an employer of labor. He prides himself upon the fact that his plant is thoroughly modern and up-to-date. He has left no stone unturned to meet conditions from a sanitary and hygienic, as well as an economic standpoint, for the benefit of his employees, but he is experiencing, as many are, a somewhat excessive labor turnover. He is also alive to the fact that employes are human, with human interests and worries, and that, among other things, death comes at times to some of the homes of his employees, removing the breadwinner or main support.

This reveals a responsibility that claims attention.

Before the appearance of Group Insurance, there were different ways of meeting such a situation—a mutual fund, for instance, or a contribution to which the firm would subscribe and thus, perhaps, a small and varying amount of money would be made available for the family. Group Insurance meets this situation as nothing else will do. While it does not solve all the difficulties incident to the activities of any business, it is a service that reaches beyond the limits of the plant—out and into the home—and thinks out for many a man some of the problems that have been most pressing upon his heart and mind, helping him protect that which is probably dearest to him—his home and family.

This may not in all cases directly stabilize labor, yet, indirectly, it does, because when once you convince the beneficiary (either wife or mother or other dependent) of the sure protection afforded by such a policy, influence will no doubt be exerted to keep the breadwinner on the job.

Another point that is referred to in the paper is that of the

moral hazard. The elimination of this feature naturally favors this form of insurance. Ordinarily, this is a very important question, for, to the medical selector of a risk, not only is the present physical condition an important problem but equal with it, is the character of the daily use or care of the entire physical machinery.

That question is eliminated very largely in this form of insurance because, where unfavorable habits are developed which might tend to shorten longevity or interfere with business efficiency, the risk would automatically cease, as a position would not be retained.

I can hardly agree with Dr. Grosvenor in the statement which he makes, that the bulk of group insurance has been written upon employees of concerns which are managed in the most intelligent and satisfactory manner, both as regards working conditions and the character of the employees. This is as it should be in every instance, but it has been my observation that many plants are very far from sanitary or hygienic and that working conditions are not always ideal. Here the element of service enters in an endeavor to improve conditions. The factory that is negligent in regard to the care of the health of its employees, where hygienic conditions are not what they should be, comes at once under the influence of the company that has effected insurance in this wholesale way. Like, perhaps, a boiler in a factory which comes at once under a supervisory influence the moment it is insured, so it is that an insuring company can render a service in connection with a group that offers an opportunity for tremendous service. I have known of instances where conditions were far from ideal when this arrangement was entered into and where suggestions for improved conditions from the company accepting the group had been immediately put into effect. Some industrial plants are, of course, ideal, but some are not. Every group is examined as an individual and as a whole, and Dr. Grosvenor puts before us very clearly the technique and practical detail for the examination of a plant, its condition, its morbidity, as well as its mortality history.

There is one other feature in connection with group insurance that is an important one, because it opens up a wide door for educational health instruction among employees, who are thus insured, by meetings in factories or wherever possible, for the explanation of what this particular plan means and coupling this with practical health instruction.

If this matter is presented aright to the employee, that the benefits are a plus proposition, given to him for the protection of his wife and children, he can easily be educated and enthused along this line, and will appreciate what is being done for his benefit, thereby making him a better employee, more stable, more efficient and relieving him of a large element of worry. When deaths occur about him and the claims are promptly paid, bringing protection and help to others at a time most needed, then the benefit is both seen and appreciated and is a good object lesson.

Dr. Root—Mr. Chairman, after reading Dr. Grosvenor's paper, and accepting the invitation to discuss it, I was unfortunately called into the field, and I have not arrived home yet, so that what data I have is more or less fragmentary, and it has been sent me on the road by our actuaries.

The experience of the Ætna in this entire field, however, shows that it is still in the experimental stage. The figures that I have cover five years, 1915-1919, and a part of 1920, and the fluctuation in the mortality rates indicates clearly enough that it has not crystallized into anything like a business proposition.

For example,

	Actual Losses	*against*	*Calculated Losses*	*Mortality by giving American Experience*
1915	about $ 264,000		$ 266,000	99%
1916	" 329,000		386,000	85%
*1918	" 1,456,000		1,386,000	135%
1919	" 1,384,000		2,299,000	nearly 60%
1920 (Jan. to Sept.)	" 1,682,000		2,400,000	" 69%

*Here is where the Flu came in.

In other words, the fluctuation in the five-year period from 60% to 135% shows, first, that while the groups are large, they are not large enough to make your losses average; and second, that we, with the others, must and are feeling our way. I do not know that I can add anything further to the discussion. It is an experiment in social science. It is an interesting one, and how it will come out, I do not know that any of us can guess.

Dr. Paul FitzGerald—Dr. Grosvernor's paper makes a clear statement concerning the aims of Group Insurance. In the time which has elapsed since this form of insurance was first written there have been a sufficient number of cases on which to base an analysis. This business has gone apace with all social welfare work, and the necessity and humanity of Group Insurance has been a matter of the education of the public, just as better air, better light, and better hygiene have been a matter of years of continual education. It is only a few years ago that it would have been hard to prevail upon a life insurance company to write this form of insurance on certain Groups because of environment. The work-rooms crowded, poorly lighted, and poorly ventilated would have been a bar. In a condition such as this the mortality experience would have been high, but with the letting in of the humanitarian light, conditions have changed until now most manufacturing concerns are acceptable for this form of insurance. It must be remembered that there are pitfalls in the application of this line as well as in the regular line of life insurance, and the common purpose of the companies to agree upon what Plan of Insurance shall be adopted is most commendable. This, of course, is accomplished by having a workable formula that does not admit of selection. As has been correctly stated, Group Insurance must carefully guard against adverse individual selection, hence the necessity for insuring the Group on a basis which does not leave with the individual the power to decide whether or not he shall enter the Group, or selection as to the amount of insurance. This militates against the acceptance of a Group in which the insurance is paid for in

whole or in part by the individual employee. Any attempt to apply Group Insurance to less than the whole available class to whom it is offered involves the danger of adverse selection entering to the degree of making the whole uninsurable and even a more vital point of insurability would be involved if individuals were privileged to choose to continue in the Group or not.

Mr. William J. Graham, Third Vice-President, The Equitable Life Assurance Society, in an address delivered before the Toronto Institute in 1918, stated that the call for Group Insurance came from employers who desired to provide life insurance for their employees without excluding any on account of individual noninsurability. The answer to this call was to discard individual selection by medical examination and to set up in substitution a method of Group selection which passes on the Group as a whole and judges it with reference to the insurability of the whole.

The cardinal principles of Group selection are:

1. To obtain a body of risks selected for purposes requiring physical and moral fitness.
2. To see that the Group is acceptable as a whole or in classes not inferior in point of insurability to the Group as a whole.
3. To grade the risk properly at the standard rate or at a commensurate extra premium rate for acceptable additional hazard. Group Insurance to be written only in accordance with a plan, particulars of which should be clearly set forth in the employer's application.

One of the following three is usually adopted.

1. A concise amount such as $1000 or $2000 for each employee.
2. Progressive amounts based upon length of service, so that, for example, all those who have been employed for less than one year will receive $1000. Those

employed for one but less than two years $1100, the amount increasing $100 for each additional year of continuous service until the stated maximum has been reached.

3. An amount for each employee based upon his or her annual wage. The maximum amount of insurance, where the insurance varies, as under plan 2 of the above, will usually be determined so as not to exceed two and one half times the average for the whole Group. The comparative low scale of amounts for the bulk of the Group with relative large insurance for a few higher officials will not be permitted.

It must be carefully borne in mind that while the employer may select any reasonable plan of insurance such a plan must apply uniformly. Special amounts of insurance will not be granted to employees for whom the employer may desire to provide liberally. We must rely largely on the honesty of the agent and the officers of the company applying for the insurance. A well-trained layman can by his inspection of the factory and the people to be insured give a very comprehensive idea of the health conditions of the place and of the character of the risks, and it is a fact that we have largely to rely upon such reports for our guidance. There is no doubt but that Group Insurance is of great value and importance, and it must be a great satisfaction not only to the employer but also to the worker whose value as a workable unit must be greatly enhanced by the feeling that the employer is paying for something that will be of benefit to him and his dependents alone.

This plan of insurance must also be considered as educational, for in a Group that is insured by the employer there must be those to whom the value of insurance becomes more real. By recognizing the provisions of such insurance and the benefits that may accrue they may be brought to a different realization of what life insurance means and so be impelled to protect themselves even more fully than this plan would afford. I am

submitting a chart showing the Group mortality experience of The Prudential, a perusal of which I have no doubt will be of interest.

Dr. H. W. Cook—Our experience is so limited in this field in comparison with that of the Equitable, Travelers, and others that I venture to give it only at Dr. Weisse's request as the experience in this comparatively new field of one of the smaller companies.

Our first group policy was written in January, 1916. During the first two years we wrote a limited number of small groups, on all of which we required medical examinations. We then changed our practice to writing groups of one hundred or over without medical examination, and in 1919 again changed our practice, writing no groups of less than fifty, and requiring no medical examination on any group.

At the end of 1918 we had $2,000,000 of group insurance in force; at the end of 1919, $5,100,000; and on October 1, 1920, we had in force sixty-seven groups, aggregating $10,500,000.

The persistency of this business has been remarkably good. In 1917 two groups, for $54,700, lapsed; in 1918 three groups, for $221,000; and in 1919 four groups, totaling $140,000. One of these groups lapsed at the end of the second year, and the others all lapsed at the end of the first year.

The mortality has been consistently favorable, the ratio of the actual to the expected mortality according to the American Table being less each year than on the general business of the Company, which has been running from fifty to sixty per cent.

Of the sixty-seven groups now in force, sixty are on concerns in the Twin Cities, chiefly in Minneapolis. We were fortunate in that the 1918 influenza epidemic was very light in Minneapolis, and the effect on our group mortality was insignificant.

All of our groups are in non-hazardous classes, consisting chiefly of flour milling concerns, retail stores, jobbing houses, retail lumber concerns, and small manufacturing plants.

Our rates have been changed from time to time, our present minimum standard rate being based on the Medico-Actuarial Table, loaded 12½% plus $1.35.

We are convinced of the market and demand for group insurance, and believe that it is a wholesome expression of a better economic and social relationship between employer and employee, and our experience has convinced us that an insurance company can safely and with benefit to itself contribute its share towards this economic betterment.

Dr. Grosvenor—Mr. President and Gentlemen: Dr. Willard mentioned among other things the uncertainty of the disability feature in connection with Group Insurance, and while I agree with him as to its uncertainty, it is a necessary requirement for the protection of the industrial employee. He also mentioned the advisability of medical inspection and supervision of disability claims. I think that any company would be making a grave error which settled or passed upon disability claims without having a medical officer responsible for the approval of the claim, after such investigation of the claim as the requirements called for, either medical or otherwise.

Dr. Willard also stated that Actuaries might properly criticise the issuance of small groups without medical examination, and reference to the subject matter of my paper will I think disclose that such groups were referred to under the title WHOLESALE INSURANCE in which short form examinations are employed and the idea is not conveyed that small groups should be issued without examination.

I think perhaps Dr. Wells complimented the Travelers to a greater extent than was intended in my paper, with reference to the sanitary condition of plants which had been accepted by the Travelers. The point which I meant to emphasize was that the mere intent of the employer to carry group insurance, his interest in the matter, showed that he was the grade of employer who took an interest in his employees, and on that general basis alone, he would naturally look after them better than the employer who showed no interest in his employees. And further, this being the case, the companies were provided with the means of helping sanitary conditions among their insured, thus performing a public service.

I cannot answer Dr. Wells' inquiry with regard to the matter

of conversion. I do not know just what the attitude of employers has been in this respect.

I feel very deeply indebted, particularly to Dr. Wells and Dr. Willard, who have amplified very largely the point which I personally, as well as the Executive in charge of our Group Department, feel, that is that the function of the Medical Department in the matter of Group Insurance is Conservation. Dr. Willard suggests the possibility that the purpose of my paper was a plea for the influence of the Medical Department upon the Group Department of the Company, and I am glad to have had him assist me in that way since the intent of the paper was directed towards the importance and value of conservation work. However, when our President asked me to prepare this paper, I gained the impression that he wanted something which would bring out to Medical Directors of companies who are not at present in Group Insurance, but whose companies might be contemplating taking up the matter, the history and development of Group Insurance. I had no idea that I could say anything of interest to Medical Directors of companies who had been in the work for some years.

Dr. Weisse—I want to thank Dr. Grosvenor for this paper, and also to thank the gentlemen who have discussed it. This discussion has put before the allied companies almost exactly what I had hoped it would.

The next two papers by Dr. Dwight and Dr. Eakins apparently present two opposite sides of the same question but they really work somewhat along the same line, and I feel sure that all the members of the Association will join with both Dr. Dwight and Dr. Eakins in admitting the gratitude we owe to Dr. Rogers and Mr. Hunter for the work that they have done in standardizing, as far as can possibly be done, a numerical system of rating applicants for insurance.

The question as to whether or not this should be used is one which every company must decide for itself—whether it should be used in its entirety or modified to suit their own needs.

SELECTION OF RISKS BY METHODS OTHER THAN THE NUMERICAL RATING

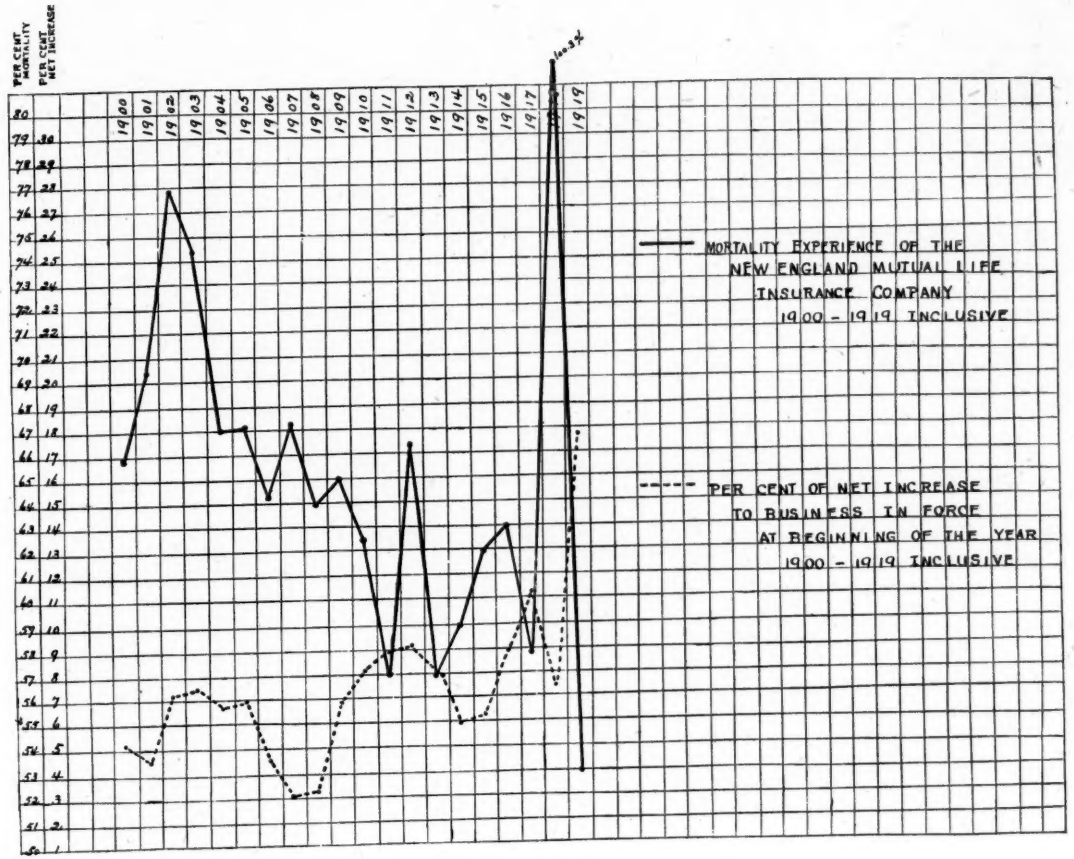
By Edwin W. Dwight

Medical Director The New England Mutual Life Insurance Company

Those of us who have been associated in the work of this Association, during the past fifteen or twenty years, can appreciate better than can the younger members what we owe to Mr. Hunter and Dr. Rogers for the information which they furnished us, in their joint contribution to our last annual meeting under the title "The Numerical Method of Determining the Value of Risks for Insurance."

This we owe them individually and as representatives of our various Companies. The amount of this debt, it is difficult if not impossible to estimate, but whether measured in terms of financial saving, personal interest, or the attractiveness of our work, it bulks large, and brings the sum of our total indebtedness beyond the ability of this Association to repay; and yet as an Association and as individuals we may, I know, look forward with confidence to the still further mounting up of that debt as they, from year to year, give us of their store of learning and their intelligent application of that knowledge to the every-day problems of our offices.

As I look upon the development of Life Insurance and the Selection of Risks, its history, in so far as our work is concerned, may be divided into a first period of perhaps sixty years during which an appreciation of the value of facts and accurate knowledge gradually and very slowly developed; a second period of perhaps twenty years during which we learned


PER CENT MORTALITY
PER CENT NET INCREASE
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MORTALITY EXPERIENCE OF THE NEW ENGLAND MUTUAL LIFE INSURANCE COMPANY 1900 - 1919 INCLUSIVE
PER CENT OF NET INCREASE TO BUSINESS IN FORCE AT BEGINNING OF THE YEAR 1900 - 1919 INCLUSIVE

reasonable, accurate and efficient methods of obtaining that knowledge; and now the beginning of the third and perhaps the most important of the three, the years during which we must work out the varying methods by which this information can be efficiently and economically applied to the varying problems of our several companies.

These three periods are sharply divided each from the other, and at each turn in the road there should, at least in our hearts, be erected a monument to these two men who stood there pointing out to us, their fellow workers in what might otherwise have been divergent paths, the efficient, accurate and relatively the easy road to accomplishment. They were, so far as I know, the first to recognize the importance of an accurate knowledge of definite mortalities, at least they were the first to set out in a broad way to obtain that information. They were the first to develop an accurate, practical, and elastic technique by which that information might be obtained; and this has been given to many of us as individuals and to the Committees of this and the Actuarial Association. Now they have put in our hands a tool of the greatest elasticity and value, which can be used in an almost endless variety of ways, in the application of the knowledge which we may have to the problems that come to us and to our companies.

I do not look upon "Numerical Rating" as a "Scientific Method of Selection"—as such it would not meet our needs or our problems, but rather as an "Instrument of Precision," a tool, an implement, of as great value, if properly used, as is the microscope to the laboratory worker or the sextant to the navigator.

It may be that if left to itself it would furnish a selection adequate to a company doing Sub-Standard business, but I do not believe it. It may be that in the skillful hands of its creators its selection will be sufficient for the company which they represent, but I doubt it, and I do not understand that any such claim is made either by Mr. Hunter or Dr. Rogers. Much of the appreciation and all of the criticism which I hear of "Numerical Rating" as developed by these gentlemen

appears to be based upon the idea that when this system has been installed and set in motion it is "all over" and Selection has been, or is being, accomplished. I do not see it that way at all. As I see it, it is after the installation has been made and its operation started, that the real Home Offices selection of risks begins. "Numerical Rating" is a wonderfully efficient, economical and accurate sorting machine, and puts the material coming to our offices in such form as to be best available for that selection which we, as officers of companies with varying problems and radically differing ideas, may consider best for our Companies and our Policy Holders.

The Selection of Risks for a Company doing a "Standard" business—which does not protect itself against poor selection by an increased premium in those classes which are doubtful or which show an increased mortality if they be not carefully selected, is a broad and delicate matter—too broad to be controlled by any one department, and too delicate and important to be left to any machine however flexible it may be.

A selection to be good must be safe, fair, efficient and economical, and if it is to be all of these, its importance both relative and actual must be recognized by all of those in whom authority is vested. A "Selection" controlled solely by the Executive, Actuarial, Agency or Medical Department of a company may very readily be a safe selection, but it will rarely be fair—and never, I think, really effective or economical. It is probably true that power is never generated and transported without some friction, but certainly the most nearly perfect machine is the one with the least friction in proportion to the power developed. The Selection of Risks is at the foundation of all forms of Insurance—and at least in Life Insurance a proper, efficient and economical selection depends upon a real and practical coördination and coöperation between the various departments who have to do with it. The old idea of the Agent that it was his duty to obtain a name on the "Dotted line" and the company's duty to "Weed 'em out"—or that of the Medical Department that all agents were "Crooks" and busily engaged in an attempt to "Put one over," were equally

false, and resulted in a selection, which in some instances was safe, but never efficient or economical, largely on account of the friction which was developed, and the waste resulting therefrom. In using the word "Coördination" I do not refer to that form which is brought about by the usual "Committee on Risks" in which each of the Departments interested is represented and each "Fights for its own hand"—the winning side being with considerable regularity that which is represented by the best fighter, or that which has the best "Pull with the old man."

Real coördination and coöperation will come only when the Executive recognizes the real and relative value and importance of each of those factors which go to make up the whole, and demands the same understanding and appreciation from each of his subordinates, when honesty and reliability are expected from the Agent, as they are from the Cashier, when perspective and at least the fundamentals of salesmanship are as much expected of the real Actuary and the real Medical Director as they are of the Agent.

Insurance is the only business with which I am familiar in which Production is subdivided into two separate and distinct departments, each under entirely separate and distinct heads, one of whom is responsible for the quantity and the other for the quality of the output. Such an organization would not be considered a reasonable one in other lines of endeavor, and very naturally it is not a satisfactory or economical one in Insurance. When such an organization is effective and the results are such as we should like to accomplish in our own Companies, it will be found that they depend upon some one man, who dominates and controls the whole. Such men are rare—hardly one to a generation, and the organization which depends for its success upon the life, health, and ability of one man is for that reason, if for no other, a very weak one, and altogether too lacking in persistence for a great business such as ours.

Quantity and quality of output go hand in hand, and one depends upon the other. The question as to which, if either, should predominate is at the basis of the organization and

should be decided at the outset and not left to chance and the relative character, ability, and force of the two individuals who may at the time control the departments having to do with production.

A necessary foundation for a good selection of risks for Life Insurance is an Executive Officer having entire charge of, authority over, and responsibility for, the obtaining and selection of risks. In other words a "Production Manager." Such a man will appreciate the importance of an accurate knowledge of facts, and therefore will see to it that his information is from reliable sources. The sources which in a general way are available in our business, are:

1. General Statistics and Information.
2. Home Office Investigation.
3. Agents.
4. Medical Examiners.
5. Inspection.
6. Confidential Sources.

1. Statistics and General Information.

When Pope wrote:

> "A little learning is a dangerous thing;
> Drink deep or taste not the Pierian Spring;
> There shallow draughts intoxicate the brain,
> And drinking largely sobers us again."

he must have been experimenting with problems very similar to our own.

Statistics are of great value if thoroughly understood and properly interpreted. Otherwise, like channel lights and buoys which have been misplaced, they are of the greatest possible danger. With a thorough knowledge of their source, their character and the method by which they were obtained, statistics are of the greatest help in our work, but without such knowledge the methods of the old fashioned pilot, who navi-

gated by the sense of smell and took warning of coming danger from the odor of "Rotten oysters on the point," is much safer.

If we believe that because some company, or all companies when taken together, show a reasonably good mortality in their groups with a "Family History of Tuberculosis," we can take all of such cases freely, we are in danger. If we believe that because one company or all companies show a high mortality with "Syphilitics" we must decline them all, we are missing a certain amount of good business. It is all a question of "Selection."

What ordinary selection will not do, refined or even ultimate selection will do.

What "Over-Selection" has done for certain groups, such as "Light Weights," "Albumen," "Family History of Tuberculosis" and certain occupations; special selection, if carried to the necessary or ultimate extent, will do for those groups which under an ordinary selection show a very high mortality. Success will depend upon our knowledge and the skill with which we use it.

2. Home Office Investigation.

The Medical Department should be as familiar with its past experience as is the Financial Department with the earnings of its individual investments. While none of us are now quite up to this standard, it is the only reasonable, practical, and accurate one possible to suggest; and the farther removed we are from it, the nearer we are to complete inefficiency. The Company which has made no attempt to obtain its own experience, has not made even the first step towards laying a foundation for a reasonably accurate and fair selection.

3. Agents.

An available source of information of the greatest possible value, which has been neglected by practically all of us, and discredited by most, is the Agent. When appointed, managed, and disciplined by an Agency Manager broad enough to understand, and big enough to be in sympathy with the Executive

Officer responsible for the selection, as well as the obtaining of business, the agent is the best possible source of accurate information along those lines of selection which are the most difficult for the Home Office to control. Inspection helps, but it cannot really control. If we are to have "Good Selection" along the lines of Residence, Environment, Occupation, Habit of Life, Habits, Moral, Financial, and Insurance Hazard, we must depend, to a hitherto unacknowledged extent, upon the agent. My experience with the "Human Animal" has left me, not entirely optimistic but, surprised at the prevalence of honesty, and secure in the belief that we get from him about what we expect. If we discredit his integrity, he is rarely trustworthy. If we have confidence in him, he justifies it to the extent that his breeding, environment, training, and mentality make possible.

I would delegate to the Agency Department authority, and a responsibility which it could not dodge, for the quality, as well as the quantity, of the work of its subordinate elements. We should not expect the impossible or the impractical, but we should expect and demand from the agent an appreciation of the fact that upon his selection depends not the safety of the Company, but a very large part of the comfort, accuracy, and economy with which the general selection by the Company is made; that if any considerable percentage of declinations occurs in his experience it represents very accurately the poor quality of his own selection.

4. "Medical Examiners."

From the Medical Department comes most of the information upon which a "Good Selection" depends, and I believe from the Medical Department should come most of the statistics upon which so much of the accuracy of the work is based. The questions to be studied are almost, if not entirely, medical, and the application of the knowledge so obtained is, or should be, in the hands of the Medical Director. The methods employed in obtaining the statistics are and must be Actuarial, but it is easier to teach clerks the actuarial method than to

make poor medical men out of first class Actuaries. Also the Actuary has troubles of his own and is, so far as my knowledge and experience go, the most ready and willing of all men to lend a helping hand to the Medical Director in mathematical distress.

After all it is important to remember that "Selection" is the most important of the responsibilities of a Chief Executive Officer who has delegated Agency Selection to the Agency Department and Medical Selection to the Medical Department. On many general subjects, and in some which are more individual, he will need the advice and counsel of the Actuary, and the need of this advice, counsel, and individual instruction from the Actuary is felt by all of us who are really trying to practice Life Insurance Medicine. The fact that two or three Actuaries, whom we all know, would make very good Medical Directors, does not mean that the same is true of them all.

The value of statistics depends almost entirely upon the homogeneity of the classes and the accuracy of the information upon which the classification depended. However valuable these statistics may be, for working purposes that value is entirely nullified if we do not have entire confidence in the information which is furnished us in connection with each applicant who is to be considered and treated in accordance with our knowledge of the class into which he should go. This knowledge comes almost exclusively from the Medical Examiner, and upon his ability, and our confidence in that ability, depend to a very large extent indeed, the quality of our Medical Selection. If we have not investigated and appointed him, we cannot have the knowledge of him necessary to inspire the required confidence. If he is the best man in the State, his most accurate findings lose all of their value, if we have not sufficient knowledge of the individual to have confidence in his work.

Good Medical Selection depends upon the accuracy of our knowledge of the individual who is presented for consideration, our knowledge of the mortalities to be expected with the class in which he belongs, and the dangers which are associated with

that class, and which are responsible for any excess mortality which may have occurred under ordinary methods of selection.

The rating up of risks according to the mortalities which have been experienced with the classes to which they belong, is justified, if it is to be justified at all, by the theory that this mortality is a flat one applying to all of the individuals making up that class. It this is not the fact, and the class is made up of smaller groups, some good, some bad, rating up may be a safe method for the Company, but it is unfair to the individuals concerned. Such a rating of such a class, if a reasonable one on the average, must of necessity be too low for the bad risks, as it is too high for the good ones.

Every class, which in the average experience, under the average selection, gives a mortality of 50%, or 600%, is made up of two groups, one with a normal mortality and the other with an abnormally high one. Under skillful selection this division may be made. The relative size of the two subdivisions will depend upon the extent to which the general mortality must be reduced, influenced greatly by the knowledge and skill of those having the selection in charge.

It is, of course, impossible to make this selection an absolute one; if it were possible there would be no need for such companies as ours. But it is possible to do our best, and the better we do, the better for our Company and our policyholders. It is along this line that the great future development in selection will come. This is a work that is worth doing, and we need such men as Dr. Rogers and Mr. Hunter to point out the way.

5. Inspection and Confidential Information.

If we were living in an ideal world—if our sources of information were infallible, and our knowledge and judgment absolute, it would be unnecessary for us to go farther for the facts that have already been suggested. Then our decision would be always accurate—our "Selection" would be perfect, and we could go out of business, for each man would know exactly when he would die and there would be neither demand for nor need of Life Insurance.

Fortunately for us this will not come in our time, and until it does come, we shall need checks on our own work, on that of our subordinates and on our sources of information.

Such service we are all receiving, and on the whole, this service in the various forms is very satisfactory.

The work of the M. I. B. Committee is almost above reproach, and yet its symbols must not be taken too seriously. These reports are made in our departments, but even we are human, and ideas vary as to the importance of some of the conditions which present themselves. Within a week my attention was called to an applicant of ours who within a few days had been reported for Heart Disease and Lung Disease, both "On examination." We sent for details and were informed that "When he hopped twenty feet on one foot his pulse went up to 105" and that he was "Somewhat flat-chested."

Two of the Companies are at the present time considerably excited over, and are contesting a claim in connection with, an individual who was declined by us some time ago, on account of the fact that we found albumin and casts in one specimen and he failed to furnish us subsequent specimens which we asked for. He failed to mention this interesting fact to these Companies when he applied to them. It is a safe gamble that the agent did not ask him the question, but I do not believe that it is fair to the rest of us that this information should be used in that way. It is intended to help in checking up our other information and in the avoiding of mistakes; not I believe to avoid paying the penalty of a poor selection.

Inspections are of great value if they are not absolutely essential to the proper carrying on of our business, and when we consider their expense they are extraordinarily accurate and efficient. The information obtained in this way is not always entirely accurate, in rare cases it is prejudiced opinions that are received, but these cases are so rare that the value of the service is not materially reduced by it. On the whole it is worth many times what it costs, and is a source of information which should not be underestimated or neglected.

A very large part of the information which we receive is confidential, and if we are worthy of that confidence it should be treated as such. Unfortunately many of us are careless in this regard and a few are excessively so. I believe that the fault can usually be laid at the door of the Medical Department. If we do not ourselves violate that confidence, we are altogether too lax in impressing upon our superiors and our associates the importance of maintaining it.

These are in a general way the sources of the information upon which our judgment as to the value of a risk must depend, and I have only in the most general way suggested some of the ways in which this knowledge may be used.

I do not like the title of my paper—it implies that I am to offer something to be used in the place of "Numerical Rating" —while if I had my way "Numerical Rating" would be established in every Life office in our Country.

Having installed it in all offices, I should then feel that they were in a position to use the brains which had been given them, the ability which had been developed, and the knowledge which they had accumulated, in the interests of the Policyholder whom they serve, and that with proper devotion to the great work in which they were engaged, their selection would be "Good Selection" because it was Safe—Fair—Efficient—Economical.

NUMERICAL RATINGS IN THE SELECTION OF RISKS

By O. M. Eakins, M.D.

Medical Director Reliance Life Insurance Company of Pittsburgh

Paradoxical as it may seem, there are two epigrammatic axioms which are more or less contradictory. One of them: A prejudiced witness is advantageous if his prejudice can be concealed. The other: A prejudiced observer rarely delivers a judicial decision.

I have no desire to be looked upon as an excellent witness,

nor have I any intention of arriving at a judicial decision covering the question of the desirability of Numerical Ratings in the Selection of Risks, but Dr. Weisse insisted upon my expressing an opinion on the subject. It is impossible for me to approach it or talk about it without prejudice because of my training and experience with it. As most of you are probably aware, I have been using the method for two decades. Perhaps when talking about the Numerical Method it is necessary to be accurate, for accuracy is one of its fundamentals. So the decades resolve themselves into nineteen years. For a little less than half of that time I sat at the feet, and was under the protection and guns of the two men, Rogers and Hunter, who were practically, to use an applicable Hindu expression, the "Father and Mother" of the Method. During the second decade, I have been free from their grumbling and criticism; free from their immediate kindly instructions; free, without let nor hindrance nor advice, to go my own way—the responsibility for any and all my actions being my own. The way I chose was the Numerical Method way, than which I knew or know of no better. This brings me immediately to the question of my "experience with Numerical Ratings in the Selection of Risks" and "the practical application of Numerical Ratings in a smaller Company," concerning which I have been asked to give you a statement.

By "a smaller Company" I imagine may be meant a Company not as large as some of the Big Companies, or a Company somewhat younger than some of the Old Companies. We hear considerable about the behemoths of the East, one of which is the "largest" in practically everything; about one in the Middle West which is also huge; and about one in the Far West, which although not as big as the Sequoia, has it as one of its symbols, and to the size of which it probably aspires. Nestling amongst these and unfortunately somewhat submerged by the surrounding industrial smokes is the smaller and younger Company under reference. As small and as young as it is, it has indulged itself in one of the great American pastimes of having "established a record." On its 15th anniversary,

which occurred in 1918, it had on its books, written entirely by its own agency organization, over one hundred millions of insurance actually paid for and in force. So far as I am informed, that record has never been accomplished by any other Company; naturally, if it be a "record."

At the time of its adoption of the Numerical Method during 1909, it had only about sixteen millions of insurance in force. At the end of 1919, there were over one hundred and thirty-seven millions, and since 1909 it has all been valued and selected by means of Numerical Ratings. During the ten years under reference the average percentage mortality of the Company has been 61.77 which included 101.3 per cent. for the influenza year of 1918 and an estimated mortality of 134 per cent. in January of 1919 when the Influenza death losses were still numerous. Excluding the Influenza affected year of 1918 the average percentage mortality has been 57.37. As you are aware, the mortality of a Company can be made practically any per cent. desired by means of selection. The favorable mortality of the Company with which I am associated was not obtained by expensive declinations nor from over-selection. The benefits of insurance were not withheld from those deserving and desiring it, as insurance was issued to all comers who were insurable. An evidence that rejections and over-selection were not employed is reflected by the fact that the average percentage of rejections by the Company during these years was 6.1. Concerning this percentage, which I have reason to know is considerably less than the average of the Companies here represented, I might say that we receive a material amount of questionable business which would not be presented at all to those Companies whose Agents know they do not issue insurance on under-average lives. It naturally follows that, were we without the Numerical Rating system and the value of various impairments, our rejection percentage would undoubtedly be higher than those Companies, rather than lower, as it is. This low rejection percentage is also notable in that we do business in the Southern States. To a great many applicants we offered insurance differing, slightly to some and materially

to others, from that for which they applied. Of the amount of insurance so offered, an average percentage of 60.9 was accepted and paid for. Whether the applicants at the beginning were pleased with our offers or not can only be determined by the individual agent interested in the individual case. Their pleasure, however, is manifested in the end analysis when you learn that the lapse ratio of that group is considerably less than 15 per cent. The unfortunate factor, for us, is evident here in that not all of our offers were accepted. It is hardly pertinent to say what percentage mortality was experienced in the group under reference as it is included in the Company's general mortality. I am not begging the question as to exactly what the mortality was, but the figures are not sufficiently accurate to quote them here. I can say, however, that its mortality was less than 95 per cent. of what we expected it to be. Our agency organization is growing consistently and persistently. Our old men are remaining with us and new men are being obtained, partly through and because of the Company's method of selection and the service which the method gives. No Agent who is worth his salt has yet left the Company's employ because of its method of selection. A few, however, have been permitted to leave, and some of them have even been urged to seek some other character of work as their ideals and opinions did not check up with the Company's summation of simple columns of figures. Requests for reconsideration of adverse action are so rare as to be events. Those men who have been with us for any length of time are perfectly well aware of the fact that opinions or pleadings or threats or even that lever of last resort, competition, do not change the answer of an arithmetical sum. They also know that reconsideration will be given instantly if the Company is provided with any pertinent facts which can be adduced to the advantage of the risk and subtracted from its former composite value. None of our Agents has been disturbed by, nor we embarrassed through, dissimilar action on similar cases. Like risks receive identical action whether taken early or late in the week or year.

To summarize briefly the foregoing running comments, it is apparent that Numerical Ratings in the Selection of Risks has worked out in, and to the decided advantage of, one of the smaller Companies. It has given it a speedy method of consistently and accurately handling risks; a profitable mortality consistent with its age and size; an economical assurance against wasteful rejections and over-selection; a favorable lapse and mortality experience in that group which is outside the limits of being average or first class; a contented and satisfied Agency Organization; and Executives who neither contemplate nor suggest any changes.

"If there is one clear fact in the psychology of our daily life, it is that the essential function of the mind is its ability to deal with the future. It is anticipation of the future that guides our conduct, plans for us, chooses, distinguishes the right paths from the wrong paths that we are to follow, and the ways that are favorable to progress from those that are unfavorable. Our memories are our experience on which we base our life to be; the present is a point, the future is everything." The foregoing comment by Frederick Peterson, on an entirely different subject, can be made applicable to the question we have under discussion. As we are dealing with end results, every action we take is in anticipation of futures. Our experience whether personal or gathered from the teachings of many others determines the path we are to tread. We shall all of us follow the path to which we have been accustomed until we are guided into a better one. And may some inspired light aid our vision to recognize it when presented.

Dr. Rogers—When I first saw the title of Dr. Dwight's papers, I was a good deal startled. I thought that a new method of medical selection was in the field to compete with, and perhaps to replace, that to which I had been giving a good deal of study for many years, and I felt that perhaps, after all, the work that my colleagues and I had been doing in the field of medical selection was about to be thrown on to the scrap-heap. I confess that after reading the paper I felt a distinct sense of relief, and particularly because, so far as strictly

medical selection was concerned, Dr. Dwight was adding the weight of his endorsement to the numerical system.

I wish that I could believe all the kindly things that Dr. Dwight has said about Mr. Hunter's work and mine in connection with medical selection. I appreciate, and I know Mr. Hunter appreciates very much, his commendation and thank him for it.

Fundamentally the paper is of great value, because it emphasizes what I think has not been sufficiently emphasized heretofore with respect to the whole subject of the selection of risks for insurance, namely, the other than strictly medical factors involved in selection. Medical Selection, that department of the subject which has to do only with medical factors, is the selection which we in this Association have been working on particularly, and Dr. Dwight's paper brings out very forcefully, I think, the other important factors which cannot be too often brought under discussion. Surely we can all, with advantage to ourselves, "read, mark, learn, and inwardly digest" what he has to say on this subject.

I do not agree with Dr. Dwight in his statement—that "every class which is the average experience under the average selection gives a mortality of 50% or 600%, is made up of two groups, one with a normal mortality, and the other with an abnormally high mortality. Under skillful selection this division may be made." But I do agree very emphatically with the thought underlying that statement. Any group of lives, characterized by any quality whatever, whether it be a strictly medical or a strictly occupational quality, if the group is large enough, is made up of lives that shade insensibly from the very best of them at one end of the line to the very worst of them at the other end, and there may very well be risks in the group that show a relatively high mortality just as there are other risks in the group that show a relatively low mortality. When we speak of a group of risks we have in mind a number of lives characterized with respect to some one quality in which they are all alike, but with respect to other qualities we recognize that they may and undoubtedly usually do possess very de-

cided differences, and with respect to those differences they have a different insurance value. Some of the lives are distinctly better than the average of the group. Others are distinctly worse. That fact to my mind is the keynote to the whole subject of medical selection. A group of lives characterized by any quality whatever, heart murmur, albuminuria, or any other thing, is made up of risks decidedly better than the average of the group, as well as of risks decidedly worse than the average of the group.

There has been some criticism of the numerical method on the ground that it is mechanical. I think that the criticism is superficial, and is in no wise justified by the facts. No system of medical selection can be used which does not take into account the fact of which I have just been speaking, namely, that lives within any group differ from one another in insurance value. It is of the greatest importance, in estimating the insurance value of any risk to have some kind of datum level from which to measure that risk. If a man is 40% over-weight, it is of great value for us to know what mortality a large number of risks of exactly that degree of over-weight will produce if taken in the mass. But it is not true that the value thus ascertained applies to the particular case in hand any more than to serve as a guide to assist in the formation of a proper judgment. I have no doubt that it would be possible, for example, to select a group of syphilitics that would show a mortality very slightly, if at all, above the normal, but I should not recommend anybody to try it because if he starts out having in mind to pick out those highly super-standard syphilitics, he will tend steadily to include within that group lives that are less and less carefully selected until he comes to look upon the whole group as super-standard. If on the other hand he remembers that syphilitics in apparently good health and reasonably carefully selected have produced in the past a mortality of 175%, and that in order to maintain in the future as good a mortality as that, it will be necessary for him to recognize that a goodly portion of the group must have had a mortality substantially above 175%, he is then in position to

judge more accurately the value of each risk that comes before him. It requires a great deal of sound judgment for a man to select risks whether he is using the numerical method or any other. The value of the numerical method lies in the fact that it helps a man's judgment by giving him a center, a datum level, if you please, from which to think. Mr. Hunter and I published a paper on heart murmurs last year, which showed that heart murmurs without hypertrophy, mitral regurgitation without hypertrophy, has produced a certain definite mortality —I think it was 170%. Now if a Medical Director goes into the sub-standard business, and he takes that 170% as the datum level from which to think of mitral regurgitation, and if he forgets to study the hypertrophy involved in the case, or perhaps the intermittent pulse, or the other factors, and rates all his risks at 170, he is going to come to grief. He is not using his statistics correctly. If he starts out to get a mortality of 170%, he must remember that some of his risks are going to be worth 120%, some of them 150%, and a few of them 140%; and on the other side of the line they will run up to 250%. And unless he takes them all into account he will go astray.

Now Dr. Dwight's paper is to my mind of very great value, for this reason, that it gives us other factors to consider besides the purely medical ones, the character of the medical examiner, the character of the agent, the surroundings of the individual as determined by the inspection report, and all of those factors that one has to take into account in producing a complete medical selection. I think that the paper is most suggestive in that respect. To turn back, however, to the part of it in which I am especially interested, the Numerical Method of valuing lives, I want to emphasize once more that no group of lives is made up of individuals of exactly the same insurance value. The insurance value of the group is only the central value on either side of which there is a considerable range of values. A man will not go far wrong who, in using the numerical method, does so with the idea that it only expresses the center of gravity of the group, that individual risks in the group range in insurance value on either side of that center,

and that he should express by some shading, one way or another, by subtraction of so much, or by the addition of so much, the real value of the risk. If, however, he gets in the habit of using the minus sign all the time, and not using the plus sign just as freely, then his medical selection will fail.

Dr. Symonds—(Read by Dr. Weisse)—All of us will agree most enthusiastically with Dr. Dwight in the praise which he has tendered to Dr. Rogers and Mr. Hunter. These two men have led us out from a quagmire of impressions to the reasonably solid ground of fact. Upon this ground of fact they have built a splendid structure of detail.

There is no doubt that a Company which is writing substandard business must use the system of numerical rating in order to attain satisfactory results. That the method is applicable to a Company writing only a standard business, is, of course, unceded, but that it is necessary to such a Company is denied. More than one half the business of such a Company can be successfully approved by lay checkers, who work within sharply defined limitations. Almost all of the applications which are disapproved by the Medical Director automatically fall among the rejected. A majority of the other applications is disposed of promptly by a well-trained Medical Director, without any need for the slow process of numerical rating. There remains a small percentage (10 to 20 only) which may be called border-line cases. In such cases there is no objection to giving a numerical rating to the basic factors of build, family history, occupation, and residence; in fact, I have personally found such a rating to be of distinct help in my further judgment of a risk. When numerical rating, however, is applied to the purely medical aspects of the case, one grave objection is found, so far as a Company doing only a standard business is concerned. It tends all the time to lead the Medical Director into a valuation of symptoms only, without regard to the underlying disease. Instead of studying a case to determine whether the applicant actually has Bright's disease, the Medical Director is mainly occupied in determining how much he will rate him for albumin and casts. Instead of con-

sidering whether the functional cardiac condition is purely neuropathic or myopathic, he is considering only how many intermissions occur in a minute and what numerical rating he will attach to them. Instead of determining whether the attack of renal colic a year ago was part of a general constitutional dyscrasia or merely a local trouble which has been cured, he attaches a numerical rating to it without really trying to solve the problem.

Now, if you are writing a sub-standard business, probably the numerical rating is the only way by which satisfactory results can be obtained, but for a Company doing standard business, it does not seem indicated excepting in the basic rating of build, family history, occupation, and residence. These factors can be rated with a fair degree of numerical accuracy and it is a good thing for a Medical Director to have such a rating before him when he comes to studying a borderline case.

When a Company uses a system of numerical rating to the exclusion of all others, the value of the Medical Examiner's opinion is minimized and in most cases actually obliterated. Apparently he is only asked to be an average Medical Examiner and the superior wisdom at the Home Office will take care of the rest. That, of course, is contrary to the practice of my own Company for the past twenty years. Probably Dr. Dwight and myself are not so far apart in our estimation of the value of the numerical rating as these words of mine would indicate. Numerical rating as developed by Rogers and Hunter, has shown to us the immense significance of many conditions which the life insurance world once thought were of little importance after a few years had elapsed. They have laid the basis for statistical study of selection upon very sure grounds.

The idea that both the quantity and the quality of production in life insurance should be under the charge of one head is very ingenious but I am afraid that it is reserved for the time of which Oliver Wendell Holmes remarked—

> When legislators keep the law,
> When banks dispense with bolts and locks—

When berries—whortle, rasp, and straw—
Grow bigger downwards through the box—

When preachers tell us all they think,
And party leaders all they mean—
When what we pay for, that we drink,
From real grape and coffee-bean—

When lawyers take what they would give,
And doctors give what they would take—
When city fathers eat to live,
Save when they fast for conscience' sake—

Even this millennial superman would doubtless give precedence to one of his mental compartments, either that one marked quality or that marked quantity and the difficulty, therefore, would be just the same as we have now.

Dr. Dwight's ideas with regard to the source of our information are most valuable and they should be well studied and appreciated by all of us. Every word that he says is worth its weight in gold.

Dr. Patton—Mr. President and Gentlemen—When I read the opening paragraph of Dr. Dwight's paper, I thought his title was a misnomer, but after reading a little further, I found that I could agree very thoroughly with his expressed obligation to Dr. Rogers and Mr. Hunter as to the value to this organization of their reports on numerical ratings. It has been of immense value to all of us, whether we are doing a sub-standard business or a standard business, but I again must agree with Dr. Dwight in his feeling that the numerical rating is not a scientific method of selection. From the medical man's point of view of the case, I do not see how we can disregard the human or the physiological element in each individual case that comes before us, to the extent that following the numerical method would cause us to do. There are so many elements of that type in a case to which it seems to me we must give attention, or we lose the scientific side of medical selection, and that I take it to be the real basis of Dr. Dwight's treatment of the subject. Companies who are doing practically no sub-stand-

ard business therefore must rely to a very large extent upon the medical nature of their selection. Companies doing a sub-standard business do not get very far away from that viewpoint. They can to a larger extent, of course, but I do not believe that they can do it very fully.

I think we can all readily agree with Dr. Dwight in the qualifications that he places upon a selection to be a proper one, that it be safe, fair, efficient, and economical. Nor do I see how any of us can get away from the classification that he gives further, as to how this selection can be brought about. There must be a coördination of all departments that go to make up the selection of our business, in order to produce the best results. Naturally the Medical Department represents the center or main factor when it comes to the question of medical selection, but many times we cannot get away from our co-ordinating departments in the company. There should be little question as to how near the Home Office departments may work together. A realization of the value of each to the other in their work ought to be readily determined. The main factor as I see it is our coördination with the Agency Departments of our companies. That presents a very serious problem. We have to obtain the confidence of our Agency Departments and to maintain relationships with them that will be such that they have our confidence. We have all had experiences in the past which have made us feel that possibly we can put little or no dependence upon some of our agencies. That is wrong. If we have that feeling we certainly should exert every power we possess to clarify the situation and to clear up any misunderstandings that may be present. As medical advisers of the company we cannot produce the best results for our business so long as any such misunderstanding exists. In our own company we feel that in the past two years we have been able to get on a much nearer plane with our field force. We have placed before them in many ways the reasons and the factors that are involved in Home Office selection, and this has brought us nearer together. We have materially increased the Home Office confidence in the agency force as a force, and I

believe that this mutual confidence is one of the main factors in reaching the proper coördination of the various departments.

In the brief time I have had to review Dr. Dwight's paper, I feel that there is no one other point that I want to emphasize more than this, the coördination of the various departments involved.

Dr. Dwight—Mr. President and Gentlemen: It seems evident that I have accomplished what I had in mind when I wrote this paper and I appreciate the opportunity which was given me because it has clarified, in my own mind at least, and I hope in yours, the real position of the fathers of "Numerical Rating." I think that those of us who are enthusiastic—and all good men are enthusiastic—are apt to be so sure of our own position, and to know exactly what we really mean, that we sometimes give a false impression to our audience. We are afraid that they do not appreciate the points which we believe to be most important, and we lay so much stress upon them that our hearers begin to think that they are the only things we have in mind.

When I wrote the paper I was not quite sure that I agreed with Dr. Rogers and Mr. Hunter, but I had worked with them long enough to have almost entire confidence in their common sense. It seems to me that practically every criticism that has been made of numerical ratings is based on a false premise; namely, that numerical rating is scientific selection. Dr. Rogers says it is "a guide to help you in the formation of your judgment." If they have given us a guide and an accurate guide, as I believe they have, then I have under-rated rather than over-rated their value to this Association. If they have given us "a center from which to think," as Dr. Rogers has said, do we not need that? Those are the two things that they have given us, "a center from which to think" on an almost indefinite series of subjects, and "a guide to help us in the formation of our judgment." I am delighted with the interpretation which Dr. Rogers has put on it this morning, and which is a little broader and, if I may use the word, a little more intelligent than the impression which they have given at

times in the past. I am delighted to know, and to have it expressed here so definitely, that instead of disagreeing, as I was afraid I might, I am very much in harmony with all that Dr. Rogers has told us and, in the light of what he has said this morning, with all the work which he and Mr. Hunter have been doing. Dr. Symonds is pessimistic, and Dr. Rogers is a little so. Dr. Symonds speaks of a tendency to "lead" the Medical Director. Dr. Rogers speaks of the Medical Director "drifting." Those of you gentlemen who have worked with these two men on the Medico-Actuarial Committee will appreciate that the only time Dr. Rogers drifts is when he is asleep. I have tried to "lead" Dr. Symonds, and he is a hard man to lead. Nor do I believe that men who are capable of occupying the positions which we occupy are going to drift very far, or be led very far, if they have "centers from which to think" and "guides to help in the formation of their opinions." I believe that this is a big job of ours, and I believe that when we limit it to the use of the word, "medical" selection, we are fouling our own nests. I do not like the term "medical selection" any more than I do the term "agency selection." The selection of risks is a very important part of the foundation of all insurance; medical selection, if you wish to call it so, is a part of it, so is agency selection, so is actuarial selection, and executive selection. We are fortunate in having to do with those problems which are the most difficult from a layman's point of view, and if we appreciate the importance of the other fellow's position and the other fellow's decisions, we will stand and be rated very high. It is up to us to appreciate that ours is a part of too big a machine to be the whole of it.

The chart which has been handed around was developed in connection with Dr. Eakins's paper. In writing me in regard to it, he said that his paper did not lend itself to discussion, and perhaps he is right, but there is one point which I think it is well for us to have in mind. It seems to me that this chart shows quite effectively what should always be taken into consideration in studying the mortalities of our companies, and that is, the influence of new business on the present mortality

of the company. The company that does not have a good mortality in its first five years of business is in a pretty bad way, and the greater the proportion of new business in force to the total business on the books, the lower the mortality. It may interest you gentlemen to know that in 1903 we began to control the use of medical examiners, and we had the Lord on our side for the next year or two. In 1905 we made an investigation of our own experience. We tried to base our decisions on facts and we tried to control our mortality so as to have it not too low, but in our judgment the mortality of such a company as ours, a company with a lot of old business on its books, should be below 70%. As you will see, for a period of years it ran under 70, averaging about 66. During that period the increase in percentage of new business, shown by the dotted line, ran about evenly. As that began to go up, our mortalities began to come down, and now we are running a mortality at times which is foolishly low. We are selecting for a mortality a little under 70, but because the agents are very efficient and have brought in a lot of business, the mortality is away down below that. Now we all know that that business is going to grow old, and as it grows old there is going to be a higher mortality associated with it, and we want to play the game as we are playing it, we want to keep that mortality if we can, with a normal increase in business, a little below 70, and when Dr. Eakins suggests that numerical rating has so radically increased the amount of their business, I think he gives a little too much credit to numerical rating, and too little to the efficiency of his agency force.

Dr. Weisse—Dr. J. B. Hall will open the discussion of Dr. Eakins's paper on Numerical Ratings.

Dr. J. B. Hall—Dr. Eakins in a letter to me very kindly stated that he regretted that his paper did not lend itself well to discussion. This may be so, because it does not give many details, but I consider it very interesting and believe that the

author and his associates should be congratulated on the remarkably good results that they have obtained.

We should endeavor to form an opinion as to what proportion of this is due to the use of the NUMERICAL RATING SYSTEM, and how much could have been accomplished by the system ordinarily employed.

The first favorable and most important point mentioned is the low mortality—viz.: 61.77% of the expected.

We all know that the mortality in any group is most favorable in the early insurance years, as its members have recently passed a medical examination and been selected for life insurance. As the years pass that fact becomes of less and less importance and the mortality becomes gradually less favorable until at last when they become old nearly the same mortality prevails among them as that of the general public.

The Company with which I am connected is a very old Company, and in the sixties was writing about forty millions of insurance each year. This amount steadily decreased until in 1899, the year in which Dr. Shepherd asked me to assist him, we were writing only about seven millions each year. We therefore, had a very large proportion of old members when compared with the new and many deaths resulted from the diseases incident to old age.

The mortality which prevailed among these old people was between 90 and 100% of the expected, although they had been good risks and the mortality of the company as a whole was from 80 to 82%.

Then our business gradually increased—our old membership decreased, and with the large influx in recent years the mortality fell until in the year before the influenza epidemic it was 58% of the expected, and so far this year is running about 64%.

We did not attribute this improvement to the method of medical selection used.

The Reliance Life Insurance Company is eighteen years old and its insured are reasonably near their medical examination. It is not top heavy with old people.

Is it not reasonable to believe that if our older method of

medical selection had been employed by a medical director of Dr. Eakins' well-known ability that the mortality would have been favorable?

I believe that it is reasonable and am not willing to give the entire credit to the Numerical Rating System—I say "ENTIRE" as there is a qualification. The Reliance Life Insurance Company does a sub-standard business and I think that we all believe that the system must be of the greatest value when applied to this.

The next important result of the use of this system mentioned is a "Contented and Satisfied Agency Organization."

Because of the stress and strain in a great insurance company—there never was in my opinion a perfectly contented and satisfied agency organization. If we could imagine the existence of such an organization we should most certainly doubt its efficiency. What the author wishes us to understand by this is undoubtedly a reasonably or unusually contented organization.

It seems reasonable to believe that the system is useful in producing this result.

Dr. Eakins states that the men who have been with them for any length of time are aware of the fact that pleadings or threats do not change the answer of an arithmetical sum, and are well aware that if new information is not submitted which changes these figures that the risks will not be approved.

Without this system we all have that understanding with our agency force—viz.: when, after investigation, a risk has been declined, the decision will not be changed unless new information is submitted which alters the facts upon which we formed our decision. Grant this, and assume a case in which much conflicting information has been received as to the previous existence of impairments, and a great deal of pressure brought to bear by an agent whose production is large, and whose connection with the Company is of great value to them —it seems to me that a Medical Director would be as liable to modify one or two of the numerical ratings which had been given to the risk as he would be to modify his opinion and change his decision made under our old system. If, however,

merit can be properly given this system for producing this most desirable condition there is another method of doing so and one which I believe is more effectual.

In our papers and talks to the agents we should show them what our duties are, as most of them think that we simply decline applications that appear somewhat below the average and in this way protect the company. They should be told that we consider that our work has been best performed when the declined percentage is low—that it is our duty to reach out into the impaired classes and select and insure as many of those submitted as we possibly can without impairing the mortality of the Company.

An incident which I have used in such talks occurred many years ago. One day our Medical Directors were absent because of illness and the President of the Company decided to act upon the applications rather than ask for the services of an outside physician. He declined nearly one half of the applications. We returned the next day and he requested us to look them over and change any decisions that he had made if we thought it advisable. We accepted them all. I remember that he declined several because the examiner stated that the urine was cloudy and others because the pulse rate was above 75 per minute.

His method would have produced a good mortality but I doubt if the agents would have been pleased.

If we can, by using illustrations of this kind, make the agents understand that we are working on their side and not in any way in opposition to them, the agency force will be reasonably contented and satisfied.

We can make them understand this because it is true and because they are reasonable men and understand that medical selection is necessary. Therefore, although the use of the Numerical System tends to produce this effect there are other efficient methods of producing it.

After such able discussion of the original paper on this subject by such authorities as Dr. Symonds, Mr. Rhodes, and Mr. Hutchinson it is difficult to find any important points not already covered by them.

There are two points which seem to me to be the most important in consideration of the system of numerical rating:

First, that it is of great value to the companies doing sub-standard business.

Second, that it is a system that makes it possible for laymen to act upon a large percentage of the applications.

I consider these points the most important for the reason that I do not as yet see how it is of great value to experienced medical directors in making their decisions.

In spite of the advance in the science of medical selection there still is, and always will be, a large number of cases in which we are obliged to decide upon probabilities.

We trace back through different sources conflicting information as to whether or not applicants have had certain impairments and after our investigations are completed cannot arrive at a positive conclusion. We are obliged to make our decision as best we can, weighing the evidence on both sides of the question with the greatest care. It seems to me that it would embarrass us and be very difficult to adjust numerical ratings to these cases.

A few companies are so large that there are hardly enough physicians in their cities to review all of the business submitted to them and they must employ either this system or another one which gives as good results. I know that several of our largest and best companies doing standard business at the present time have a very large percentage of their business acted upon by laymen and are able to do this by laying out simple rules for their guidance, and the medical directors of these companies are among the most able men in our profession.

The point which is of greatest interest to most of us present is—whether the system should be adopted by companies of moderate size not doing sub-standard business. Each company must, sooner or later, decide upon its own course of procedure.

A large number of us employ the services of laymen to act on a part of our applications. Usually these are experienced men who have spent the greater part of their lives in the medical department and whose opinion upon insurance applica-

tions is actually of great value. They know exactly what is expected of them and are very careful not to go beyond a certain point. I think that it would not be to our advantage to burden them by requiring them to attach the numerical ratings to all the applications upon which they act—nor do I believe that their decisions would be any more accurate.

Although both Dr. Eakins and the author of the original paper make the point that greater speed is possible, I cannot understand this as it seems to me that it would greatly delay action on a large percentage of the applications.

Perhaps the main objection to the system lies in the matter of overlapping rates as it must be very difficult to set down and adjust all combinations of dependent factors that must arise in practice. Those who employ the system seem to be able to meet and control these difficulties but in a smaller company it would be a long period before some combinations would occur and then in an automatic system which had been in operation for some time there would be liability to overlook the combinations.

Another result mentioned by Dr. Eakins is the low percentage of rejections. His percentage is low but it may be that those who accepted sub-standard insurance from his company are not included in this percentage and that, therefore, it cannot be compared with that of a company doing standard business alone.

The author of this paper closes with a quotation which I will in part repeat:

"If there is one clear fact in the psychology of our daily life it is that the essential function of the mind is its ability to deal with the future. It is anticipation of the future that guides our conduct, plans for us, chooses, distinguishes the right paths from the wrong that we are to follow, etc."

In this quotation I detect a menace, for if in the future our presidents suddenly decide to write sub-standard insurance, and we do not use the numerical system it will be necessary for us to devise and put into practice one which will produce as good results, and if we are ever expected to do this—may we receive assistance from above!

Dr. Brown—Mr. President and Gentlemen: We are told that some insistence was necessary on the part of our President to bring forth this paper by Dr. Eakins. Surely we must commend Dr. Weisse for his action and thank the author for the testimony which he brings to us. It is of considerable moment to know that the plan of numerical ratings is as satisfactory for a small as for a large volume of business. To use the remark which Dr. Rogers has already quoted, "The proof of the pudding is the eating of it." As one reviews the transactions of the Association there can be traced from the beginning a constant desire to learn the truth and to formulate accurate and equitable means to deal with those who come to us for insurance. In reviewing the history of medicine from Hippocrates and Galen to the researchers of the present, there is noted an almost continuous advance in the science and it is quite probable that our knowledge of to-day is but an atom compared with the truths and facts which are to come. In our own field of action there is no greater monument than that erected by Mr. Hunter and Dr. Rogers and given to us under the caption of "The Numerical Rating in the Selection of Risks." I venture to predict that long after we have ceased to attend these meetings the names of these men will appear in the transactions and their work commented upon with favor and commendation.

This plan has been the subject of much of my thought, yet so much has been said concerning its merits and disadvantages that I find most every feature of which I would speak has already been discussed.

It would seem that a company to successfully use this method of selection must base its action upon its own experience. I am in accord with the hypothesis that, under exactly the same circumstances, what has happened will happen again. One must realize, however, that the methods of securing medical information vary in the different companies. Medical blanks are not alike, some are particularly adapted to bring out certain forms of information while other blanks are so constituted as to lay emphasis upon other features. Urinalyses differ, some

companies depending entirely upon examinations by a variety of physicians in the field, others maintaining facilities for examining large numbers of specimens in their Home Office. The average economic status of applicants coming to the various companies is not the same. We are all familiar with the difference in mortality experience of certain classes of the medico-actuarial investigation and the experience of an individual company for that class, which cannot be entirely explained by the inaccuracy of small groups.

I presume that it is the desire of all companies to give to an applicant insurance at cost plus a certain sum which business exigencies legitimately require. Are we to assume it equitable because an applicant at a given age has an intermittent pulse that regardless of the gravity or cause of the condition, those with an inconsequential impairment must pay for a mortality increased by entrants in which an intermittent pulse denotes a serious myocardial disease? Is it not more logical to endeavor to determine to which one of a score of causes this abnormality is due and to act upon the application from that viewpoint rather than debit a given number of points because of certain general findings.

A history of rheumatism causes a debit. Dr. Bradshaw, in his paper on focal infections, very properly raises the question as to whether or not the removal of the etiological focus should have its bearing in considering the acceptability of the risk. Does the numerical rating take care of such a very important medical question? As medical knowledge increases, as complicated problems resolve themselves into simpler ones because of advances in research, will the Numerical Ratings Method be sufficiently elastic to permit of up-to-date modifications? To determine even approximately a mortality experience there must be years of exposure, at least a decade must elapse before a medical advance can be incorporated in this method of rating. I am quite sure that in judging a risk which has a history of syphilis, all of us would be influenced by a positive or negative Wasserman. Does the Numerical Rating as practiced to-day take into consideration this feature?

Please realize that I am not condemning the method in its entirety. There are many features of it that anyone would be justly proud to have attributed to him, but may we not lose sight of the fact that the science of disease is still a science, that we must draw upon all its branches in our prosecution of selection, that medicine is a hard master, and the branch which we practice cannot be conquered by figures alone, however numerous. If we are to succeed we must continue to accumulate knowledge, acquire wisdom, adjust ourselves to contemporary medicine, and exercise judgment.

Dr. H. W. Cook—After notice of the titles of the papers to be presented by Dr. Eakins and Dr. Dwight, I awaited the advance proofs with the greatest interest thinking that they would defend somewhat opposed points of view, the one advocating and the other deprecating numerical ratings as a guide to selection of risks, but I was rather relieved to find that as far as I could gather both essayists were the warmest possible exponents of numerical rating, Dr. Dwight, perhaps, being even the more enthusiastic when he says "Numerical rating is a wonderfully efficient, economical, and accurate sorting machine,—puts material coming to our offices in such form as to be best available," and further stating that if he had his way, numerical rating would be established in every life office in our country.

As a matter of fact, I believe Dr. Dwight's wish is a reality and that numerical method is used to a limited or a greater extent in every home office, and has been so used, at least since the results of the Medico-Actuarial Investigation have been available. The extent to which numerical rating is used depends usually upon the dependable data which is available in each office, and varies from the data at hand in the New York Life office to that of a company which is using only the data on weights and build to estimate a mortality percentage beyond which they do not deem it sound underwriting for that company to assume liability. To that limited extent, however, such a company is using the numerical method. We freely confess in our home office that our use of the numerical me-

thod is limited only by our knowledge of either experienced or estimated mortality percentages which we consider sufficiently reliable and accurate to justify adoption as a basis of action.

I do not understand that the numerical method has any obligatory relationship with the issuance of sub-standard business. A company could discontinue its sub-standard business to-morrow and still would continue to use its numerical method just as effectively in the selection of standard business. I understand the numerical method merely to be a means of expressing our knowledge of the mortality which can probably be expected from certain reasonably homogeneous groups in terms of percentages which are comparable and intelligible and constant, instead of in terms which are vague and variable. Of course, the numerical rating reaches its most useful expression in a company which attempts to grade its rates in accordance with the hazard of the class. We have been attempting to develop our numerical rating during the past fifteen years and have applied it as far as it had developed in the selection of our standard business and in the rating of our sub-standard classes. Our experience accords closely with that expressed by Dr. Eakins for the Reliance. Our percentage of rejections has been reduced to less than 4% on the average during the past five years; our agents have felt that the sub-standard classes were consistently and equitably rated and added from 8 to 10% to their earning power; the applicants have apparently been satisfied as they accept our offer in a profitable majority of the cases and have had a low lapse rate; and we feel we have effected a public service in affording protection to family and credit that would otherwise have been denied. We do not feel that the use of a percentage system of ratings has narrowed our viewpoint or made us less able to modify our practice in the light of new facts or new knowledge.

We do not have to be as unreasoning in the application of percentage ratings as the woman to whom, in the course of her medical examination, the examiner put the usual question —"How many children have you had?"—"Three," she answered, and then added with conviction, "that'll be all I'll

have too." "Well, that's all right," said the physician, "but why so positive about it?" "Why," said the well-informed lady, "I was reading our encyclopedia the other day and it said that every fourth child born into the world was a Chinaman." This statement was probably as true as some of the percentages in the Medico-Actuarial tables and lent itself as readily to misinterpretation.

On the other hand, we do feel that in as far as we have been able to develop it, that the numerical method has standardized our action—given us a more accurate perspective and is rapidly gaining for us, as our volume and experience grow, an immense amount of valuable and intelligible data which we could not otherwise have had.

I want to add my appreciation to that already expressed by others, for the debt in this connection which I feel I personally owe and which my company owes to Dr. Rogers and Mr. Hunter.

Dr. Eakins—Unfortunately my paper is not of a character which lends itself readily to discussion in that it savors of being more personal than general, and is really an answer to a question propounded rather than a theory expounded. Being such, I am lost in admiration for the gentlemen who have made a difficult task seem easy, and am confused at the gentle and courteous manner in which they have treated me personally.

I do not know the author of the following paragraph as it was printed anonymously. In a semi-facetious mood it remarks that: "Man's conceit persuades him that he and those who share his opinions have cornered the world's visible supply of wisdom. Agree that he has the right of it and he will think you an intellectual. Attempt to prove him in error and he will think you a fool. Reformers are without honor until the world catches up. The man with a new idea is frequently in danger of his life. The world wishes to be told the things it already knows, it delights in platitudes." If one would be publicly popular it behooves him to "follow the mental paths frequented by those he would impress." Rogers, being a "reformer" of sorts and possessed of a new idea, has had an

equivocal and thankless row to hoe during the twenty and more years of his notion. But now that we have almost caught up with him, open threats of murder against him have ceased, criticisms are no longer vituperative and his honors are rapidly materializing.

Being an able man, Dr. Dwight once admitted—and none but an intelligent man would so admit—that for a period he did not thoroughly understand what Rogers was driving at. It is not probable but it is humorously possible that such an admission was a tactful shaft at Rogers' powers of explanation. In any event, Dr. Dwight's intelligence remained with him, and, again jestingly, Rogers' discourses clarified, permitting the light to dawn. That it did dawn in its full glory is evidenced by Dr. Dwight's thesis of this meeting wherein it is clearly stated that if he had his way "Numerical Rating" "would be established in every Life Office in our Country."

I am thoroughly in agreement with Dr. Dwight that "Numerical Rating" if left to itself would not furnish any Company an adequate selection, but that it is an "Instrument of Precision," to be used intelligently, and as such is a most desirable aid in reaching that ideal, an adequate selection. I agree also that Numerical Ratings may not be fair, but they are no more unfair than The Table itself on which premiums are based. The flat mortality which is presupposed to exist in any class, whether average or not, fails miserably when applied to an individual. There are better and worse individuals and groups in all classes. Were it not so we would each of us live and have our being and die on our three score and tenth anniversary. The better members of all classes provide for the worse members therein, be they standard or sub-standard or whatever you may be pleased to call them. The millennium is not yet and God in His mercy has not seen fit to take us into His confidences to the extent of our being able to say what lifetime may be expected by any particular individual.

A considerable amount of criticism has been leveled against the Numerical Rating because of its rigidity. Dr. Dwight very aptly called it a tool of precision. There are tools of pre-

cision, and there are tools of precision. Some of them are particularly rigid as evidenced by tap gauges, and some of them are particularly flexible, as evidenced by Vernier gauges and microscopes. To me one of the most desirable features of the Numerical Method is its flexibility. It is flexibility personified. Dr. Rogers intimated that he could conceive of groups with specific infection that might be selected where the mortality was *almost* normal. It is the height of absurdity to imagine that because of the minus signs which are available in the Numerical Rating they should be used to such an extent as to make a risk which everybody knows is one to be declined into a risk which may be accepted at regular rates. The question was asked privately, Would you take a risk straight with a heart murmur, the rating for which is, roughly, 160? Take off a minus sign for his family history, a minus sign because of his occupation, a minus sign because of the plan for which he is applying, and presently will you issue the man Term Insurance? Obviously, gentlemen, that is absurd. Just as obviously, it is an evidence of the flexibility of this tool of precision which has been given us by Dr. Rogers and Mr. Hunter.

Combining the topics raised by Dr. Dwight and Dr. Hall, covering the question of mortality, I was particularly interested in Dr. Dwight's photograph, as I was once faced by a very similar state of affairs as confronted him in 1903. At that time, and I am going back to the beginning of this paper, in 1909, my company was particularly young, and was experiencing a mortality very much higher than it should have. I imagine the high mortality was due to bad luck rather than anything else. In any event, being more or less obstinate, like Dr. Dwight, I decided that something had to be done about it. Something was done, as evidenced by the figures in the body of my paper. I am not so foolish as to endeavor to get a low mortality. My company is working for the future. It knows that in the fullness of time it is going to have a very material volume of business on its books. So far as its selection is concerned it is working for something a little lower than 70%. In the course of time I believe it will reach just about

that. I have not our figures in graphic form but they are pretty much of a muchness with those of Dr. Dwight's graph. Our mortality of 1918 I think was a little higher than his. The low mortality which Dr. Dwight is now experiencing has also been experienced by our company. I think I am saying that which is known to everybody when I suggest that after all epidemics there is a very material lessening in mortality. I believe that is one aspect of what we are getting now.

If before to-day there were anything further to be said about the desirability of the Numerical Rating in the selection of risks, Dr. Rogers said it this morning.

Dr. Weisse—Dr. Bradshaw opens up a new line in his paper on the question of Focal Infections. These irritating, elusive, and altogether objectionable conditions, are being constantly brought before us by medical literature at the present time. I think that some of the points which Dr. Bradshaw makes in his paper, with reference to our relation to the removal of focal infections in diseases caused by them should be very seriously considered. I wish to cite a case which came under my own observation several years ago, which I think bears directly on this paper. Mr. W., aged 46, was examined by Dr. Brush on October 13–14, 1917, who found pulse irregular and intermittent in both force and frequency—blood pressure 148–106—arteries, tense—systolic at apex with forcible impulse over precordium—occasional hyaline cast.

The tonsils at the time of examination, showed evidence of considerable infection, and Dr. Brush recommended removal which Mr. W. had done, in November, 1917. Dr. Brush examined Mr. W. again on the 21st of February, 1918, and found him abso-

lutely normal in every respect. He examined him both in the recumbent and upright positions.

I saw Mr. W., in Nashville on April 14th and examined him with Dr. Brush and was unable to find any abnormality with the heart, arteries, or urine. In view of these findings in the history, I recommended that Mr. W. be accepted for $25,000 and since that time we have issued $10,000 additional. Dr. Brush saw Mr. W. on October 8th and was kind enough to examine him for me so that I might have the latest report. At this examination Dr. Brush found the heart and urine to be absolutely normal and gives a history of Mr. W.'s being in perfect health since the time of the removal of his tonsils.

My personal opinion is that this case is only one of many in which the eradication of the focal infection will make a very great change in the general systemic condition.

FOCAL INFECTIONS IN RELATION TO LIFE INSURANCE

By William M. Bradshaw, M.D.,
Medical Inspector, Mutual Life Insurance Co. of New York

Modern medicine has demonstrated the very important fact that the human organism must be regarded in its entirety, irrespective of the symptoms of which the individual complains or the condition for which the physician is consulted. Treatment based on symptomatology alone may be successful in the simple maladies in a given case, but in the majority of cases the cause of these symptoms may be very remote from the region affected. The recognition of this principle, that a pathological condition of one organ or region may affect some

remote organ or region, has not only revolutionized the clinicians' methods of examination and treatment, but has proved of value in determining the etiology of some of the most obscure disease processes. Since the first paper on focal infections by Billings in 1912, tremendous enthusiasm has been manifested in this subject and in the short space of eight years, many valuable articles on the etiology, pathology, and results of treatment have appeared.

Focal infection as a cause of disease has come to stay. Many of those who accept the principle have not thought just what the term means. A focus of infection differs from a focal infection. What is meant by infection? *Infection* is the act or process of invasion of the body by pathogenic micro-organisms that have the power of reproduction in the host, the reaction producing abnormal phenomena, which we term clinical manifestations of disease. A *focus of infection* is a circumscribed area of tissue infected by pathogenic micro-organisms. *Focal infection* means the invasion of the body and proliferation there of pathogenic micro-organisms from a focus of infection. Foci of infection may be primary and secondary. Primary foci usually are located in tissues communicating with a mucous or cutaneous surface. Secondary foci are the direct results of infection from other foci through contiguous tissues or at a distance through the blood stream or lymph channels.

Pathology:

It is well-known that lymphatic nodes are so distributed as to protect the body against absorption of dangerous matter from certain well-recognized sources. Indeed, lymphatic tissue in any amount occurs, generally speaking, only in those localities where such absorption is occurring. We find clusters of glands at the hilum of the lung, in the mesentery, in the axillary and inguinal regions, the cervical region, etc.

In the alimentary canal from the lips to the rectum, Davis has shown that there are two localities where striking accumulations of lymphoid tissue appear—namely, in the pharyngeal

region of the throat and in the lower small intestine, especially about the ileocecal valve and appendix. The intervening localities like the stomach, duodenum, and the large intestine have lymphoid tissue, but it is irregularly distributed and far less in quantity. At first glance this would indicate excessive absorption of dangerous matter in the localities where the lymphoid tissue is abundant and, as a matter of fact, this appears to be true, for in the throat and in the region just above and below the ileocecal valve, we find normally the greatest number and variety of bacteria. This is proven by smear and culture preparations made at intervals along the alimentary canal. If one should represent the amount of lymphoid tissue along the canal by one curve, and the number of bacteria normally present by another, the two curves would in general parallel each other. Beginning at the mouth the curves rise rapidly, attain a maximum in the pharynx, then descend in the small intestine, gradually approaching another maximum about the ileocecal valve, and then descend somewhat toward the rectum, where many of the bacteria die.

In the throat the palatine tonsils represent the greatest single accumulation of lymphoid tissue, while in the intestine the agminate glands of Peyer and the appendix represent the same. The significance of these accumulations appears to be that of a protective mechanism. In these two localities not only is the normal bacterial flora more highly developed, but here also occurs the greatest number of infections. It has been definitely established that on the surface of the tonsils the streptococcus viridans type of organism predominates while in the crypts of the same tonsils the streptococcus hæmolyticus may be found. Not infrequently pneumococci, diphtheria bacilli, the viruses of the numerous exanthems and other diseases are isolated from the throat. In the lower intestine there is typhoid, paratyphoid, the dysenteries, tuberculosis, and various types of appendicitis. At times these pathogenic bacteria become adapted to grow in lymphoid tissue and attack the very mechanism which the body has apparently designed for its protection. Indeed, in some cases

the mechanism breaks down entirely. Instead of being protective, it furnishes a fertile soil for invasion. When this advanced condition has occurred it may be of advantage to remove this mechanism, or a part of it, as is done in tonsillectomy and in appendectomy.

As to the teeth, Endelman and Wagner in their recent book, ***General and Dental Pathology***, clearly and concisely state the problem as follows: "If an acute or chronic infection about the roots of the teeth does not give rise to systemic manifestations, it is not because the bacteria and toxins concerned in the infection are not in all cases at the portals of absorption, but rather because individuals are frequently able to ward off successfully a bacterial invasion. The blood supply of the peridental membrane and the surrounding alveolar structures are not separate and independent vascular areas. The vessels anastomose freely among themselves. An infection located at the apex of a root quickly spreads to the medullary substance, a tissue rich in blood vessels and lymphatics and a septic osteomyelitis is set up. At no time is an acute or chronic apical infection a localized infection."

It must be recognized that present-day knowledge associates certain types of systemic disease with a primary focus of infection. The character of the systemic disease may point to the most likely location of the focus. The primary focus of acute rheumatic fever, endocarditis, chorea, myositis, certain types of neuritis and nephritis, albuminuria, peptic ulcer, cholecystitis, appendicitis, and chronic deforming arthritis, as examples, is usually located in the head and usually in the form of alveolar abscesses, acute or chronic tonsillitis, or acute or chronic sinusitis. One looks for the focus of gonorrheal arthritis in the genito-urinary tract. In the more obscure conditions a bacteriologist or roentgenologist, or the services of specialist of the ear, nose, and throat, pelvic organs or the gastro-intestinal tract may be demanded. It is to be deplored that a focus of infection is usually disregarded by the patient and physician unless it causes local discomfort.

In a recent paper on the study of rheumatic fever cases,

admitted into Bellevue Hospital between January, 1906, and September, 1919, Dr. Alexander Lambert well illustrates both the cause and effect relationship of focal infection disease and the striking results of treatment of the focus. From 1906 to 1914, admissions averaged 546 cases a year, while from 1914 to 1919, the average was 346 cases a year, a decline of 200 cases a year. In 1912 and 1913 the knowledge of focal infection was spread among physicians, at which time dental clinics and tonsillectomy clinics in the city and private hospitals became vigorously active. The biggest decline in cases was noted in age groups 10 to 14 and 15 to 29, those in whom prophylactic work is most likely to be thoroughly done.

Billings in a chapter on acute disease related to focal infection states that "rheumatic fever occurs most frequently in the temperate zone, among people who live under conditions which are unhealthful and which especially induce focal infection. It is most prevalent in the young and in the more exposed males of all ages. The excess of lymphoid tissue in the pharynx and nose of the young explains the frequency of the incidence of the focal infection and subsequent rheumatism. The frequent absence of evidence of acute focal infection at the onset of the systemic disease is not an evidence that no focus exists. The latent chronic streptococcus infection of tonsillitis, pyorrhea, alveolaris, sinusitis, etc., may suddenly acquire increased virulence and specific pathogenic affinity with varying degrees of focal tissue reaction. The removal of tonsils and other sites of focal infection has been followed by complete recovery of prolonged, subacute, and chronic types of arthritis and has unquestionably prevented recurrent attacks of rheumatic fever to which the susceptibility is increased by one or more attacks. The occurrence of rheumatic fever after the removal of an apparent focus may be due to secondary systemic latent foci in lymph nodes proximal to joints, in the neck or elsewhere. The streptococci of these secondary foci may take on new virulence and specific pathogenicity, from the same causes which induced like changes in the pathogenic bacteria of the primary focus."

Of particular interest and significance to insurance physicians are Billings' observations on acute and chronic nephritis. "The type of acute infectious nephritis which usually rises from a focal infection is embolic because the mode of infection is hæmatogenous. It is, therefore, primarily a glomerulonephritis. If the dose of infectious bacteria reaching the kidney is large enough, the nephritis may be diffuse. Usually the condition is expressed clinically by bloody urine of varying degree, microscopic blood is present with albumin and casts of various types. Varying degrees of this type of nephritis occur from focal infection. The most usual site of the focal infection which causes the nephritis is the throat. In the milder types of this form of nephritis apparent complete resolution occurs after removal of the focus of infection."

"Chronic infectious nephritis due to focal infection is very common. Probably it has first existed as a subacute infectious nephritis and not infrequently occurs as a hæmatogenous infection of the kidney from some focus resulting in anatomical changes of various degrees. Chronic infectious nephritis like the subacute and acute types, is usually due to strains of the streptococcus which have a specific selective affinity for the kidney. Every clinician of experience has observed patients over long periods of time who have presented primarily evidences of acute or subacute nephritis of infectious origin and who have finally succumbed to chronic nephritis. That a focal infection may be the source of the kidney lesions and may lead to a chronic irreparable renal disease, must be emphasized. Early removal of the etiologic focus may prevent further anatomical insult of the kidneys and preserve renal function and life."

Experimental nephritis was produced in rabbits by inoculation with strains of streptococci isolated from patients with epidemic septic angina. The kidney lesions were primarily of the vascular structures, glomeruli, inter-tubular vessels, and arcuate and interlobar veins. The tendency to repair noted in this acute glomerular lesion is very important when compared with the tendency to recovery of clinical glomerulo-

nephritis of man when the chief etiological factor is removed.

In summarizing the results of treatment of six cases of subacute and chronic nephritis due to focal infections, four were completely cured clinically and were able to produce several specimens of normal urine free from serum albumin and casts. Six months was the average time for complete recovery. Two cases were greatly benefited, the urine showing only an occasional trace of serum albumin or hyaline casts, the other subjective and objective symptoms having been entirely relieved.

In obstetrics a careful observer reports focal infections, particularly those of the teeth, as the cause of certain breast abscesses, of pyelitis, albuminuria, some types of toxæmia and at times eclampsia; a large portion of the uninduced miscarriages are primarily due to the same cause. Inflammatory foci cause a rupture in the villous membrane with the ultimate formation of a hæmatoma, causing a separation of the placental tissue from the uterine wall. If there is sufficient separation, internal concealed hæmorrhage or external hæmorrhage occurs, according to the location of the inflammatory process in the placenta. If the hæmorrhage is sufficient to terminate the pregnancy, a miscarriage is the result. It was also noted that every baby which developed hæmorrhage of the new-born had come from a mother in whom foci of infection in the teeth could be demonstrated and a high proportion of such mothers showed some signs of toxæmia during their pregnancy.

Relation to Life Insurance:

In passing on the insurability of risks the Medical Director not infrequently has presented to him a history of systemic disease of the focal infection type, the focus usually not mentioned; or evidence that an actual focus is or recently has been present. What is the procedure? For example let us take a history of one recent attack of mild, uncomplicated rheumatic fever applying for some form of standard insurance. The usual action is to postpone such a risk six months to one year. On reëxamination the question of interval removal of

diseased teeth or tonsils or the cure of a chronic sinus is not investigated or examined for. If the applicant has not had a recurrence of rheumatic fever and is otherwise all right, he is accepted. In view of our present knowledge is this action correct? The answer is No! We do not accept cured cases of gonorrheal arthritis unless the associated urethritis is cured. Is it right to accept other systemic focal infections without first insisting on the complete eradication or cure of the primary focus?

On the other hand suppose on examination a focus of infection is discovered. It may or may not be associated with present or past systemic disease. Here the life insurance examiner has a unique opportunity. To advise and secure proper treatment or eradication of the focus is the objective. To secure it the applicant and the agent will need education. In the minor conditions a short postponement only is necessary; in the more serious conditions such as chronic sinusitis or chronic appendicitis a longer period is needed. It is appropriate to quote a word of warning given by Dr. W. S. Thayer in a recent discussion of this subject. "The attempt to treat these foci of infection properly has made common, surgical operations which were not so common years ago; and it has brought into use certain specialties of surgical procedure which were not common years ago, surgical procedures of a very delicate character, which only the best trained man is capable of carrying out. I know many men whom I would be glad to have take out my appendix, if it were necessary. I know very few men whom I would be willing to have take out an adherent tonsil or interfere with ethmoid disease."

In my opinion, if insurance physicians took a definite stand on this subject, the public and companies would be mutually benefited. A decrease in rheumatic fever is already noted and attributed to better dental hygiene and removal of diseased tonsils. Of the more serious conditions it is not unreasonable to predict a decrease in nephritis, endocarditis, and the progressive types of arthritis. The propaganda once started and consistently followed would surely bring results.

I recognize that the Medical Profession has reacted in two curious ways to the knowledge of focal infection. One class apparently has denied their existence; the other, to cover their sins of ignorance, have found focal infections as a cause for nearly every known disease. Billings's word of warning covers the situation admirably. "Much of the fallacy and failure in the treatment or management of the patients who suffer from what may be proved to be focal infection is due to the fact that the physician or surgeon in charge removes a focus, which may be the right one, and then neglects any further management of his patient. If you have removed the true focus, you have simply prevented the invasion of the tissues by additional organisms from the primary focus. What is your duty? Our duty is to build up the resistance of the host against the invaders already there by all of the known means of support of the patient from the beginning of treatment."

One needs to be a believer in only a part of the statements made to be impressed with the seriousness of the situation. What specific thing can be done? Primarily we must recognize that certain diseases are the result of focal infections. Then if a focus has been thoroughly and completely eradicated and the systemic disease caused by it has not been of long standing or too often recurrent, insurance may be issued two to six months after operation, the postponement somewhat dependent on the location of the focus found. I believe the present method of postponing an applicant giving a history of a focal infection disease and later accepting the risk on a statement that there has been no recurrence of the same disease, is wrong. If the focus has not been removed the risk is not standard. A recurrence of the disease may be expected in a large percentage of cases. If the focus is entirely removed by a competent surgeon or dentist the risk becomes standard in a very short time and liability to recurrence is practically negligible.

We may not hope to modify the actions of individuals or society so that communicable diseases will disappear or that susceptibility to infection will be overcome, for we cannot

wholly prevent or abolish the marriage or procreation of the unfit; alcoholic and drug addictions; poverty, unhealthful domiciliary and occupational environment; community uncleanliness and other causes of mental and physical debility, which directly diminish the natural body defenses. The control of these debility factors is a function of national, state, and municipal public health bodies.

As far as possible, both individually and collectively we should exert an influence to promote cleanliness of mind and body and thus lessen the incidence of focal and systemic infection. To physicians this is a shop-worn subject, to the majority of the public it is still an uncut book. The encouragement of personal cleanliness and especially the care of the skin and its appendages of the mouth and throat, should be a duty of the insurance physician. A careful examiner should be able to recognize focal infections and to properly appraise them. The Medical Director in the selection of risks is not infrequently influenced by occupation, habits, build, family history, past history, and many other factors. In view of the scientific and clinical evidence accumulated in the past eight years, should we not consider the presence or absence of a focus of infection or evidence of its complete medical or surgical cure another very important item in comprehensive selection?

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Through Dr. Porter's absence on account of illness, Dr. Russell will read his discussion of Dr. Bradshaw's paper.

Dr. Wm. Evelyn Porter—The subject of Dr. Bradshaw's admirable paper—"Focal Infection in Relation to Life Insurance,"—was well chosen, as it presents to this Association facts of the utmost importance in their relation to medical selection at the present time. Whereas the subject has commanded the attention of the profession for nearly a decade, little if anything has been done to meet the changes in relation to etiology and pathology of conditions dependent upon bacterial and toxic infection from the life insurance standpoint. A review of the medical blanks of many of our companies will fail to reveal adequate mention, if any, bearing upon this far-reaching and important question.

At the outset the definition so well presented by Dr. Bradshaw of *Infection*, *Focus of Infection*, and *Focal Infection* should be kept clearly in mind. Although most of you have it before you in galley proof, I shall repeat it. "*Infection*" is the act or process of invasion of the body by pathogenic microörganisms that have the power of reproduction in the host, the reaction producing abnormal phenomena which we term clinical manifestations of disease. A *Focus of Infection* is a circumscribed area of tissue infected by pathogenic microörganisms. *Focal Infection* means the invasion of the body and proliferation there of pathogenic microörganisms from a focus of infection.

Scientific experimental methods have afforded a vast fund of information as to infectious agents, their manner of entry, transmission and reactions to which they give rise. A long list of microörganisms has been established as the probable pathogenic agents, the most important of which are the various strains of streptococci and staphylococci. The determination of the particular focus of infection in any case must depend, first, upon our knowledge of the organism commonly causing such disease and its probable source; second, upon

careful examination of these sources; and third, upon a complete history of the case.

Hæmatogenous Infection, or dissemination of the pathogenic microörganism through the blood vessels, is the most frequent manner of producing systemic infection from a focus of infection. Gaining entrance to the venous channels at the site of the primary focus, the bacteria are carried to the heart and lungs, ultimately lodging as minute septic emboli in capillaries of various tissues. The occlusion of small blood vessels and proliferation of their endothelial lining results in formation of septic thrombi or ecchymosis. Streptococcus hemolyticus and streptococcus mucosa lead to necrosis; streptococcus viridans to proliferation and staphylococcus aureus or albus to pus formation.

Lymphogenous Infection through the lymph channels and nodes is another course of infection, as where the primary focus is in the tonsils, sinuses or wounds of the skin. With this type, infected lymph nodes may become secondary foci of infection.

Whereas there is a diversity of opinion in the profession as to the actual relation of cause and effect, in its bearing upon some of the diseases involved, sufficient facts have been established to demand careful inquiry on our part in considering the acceptability of applicants for insurance.

The question of pathology is important and scientific study is progressing actively among the leading pathologists of the country, which will doubtless result in further valuable information in the near future. Sufficient evidence has already been accumulated to establish a definite relation of infection to the conditions formerly classified as articular and muscular rheumatism; various types of neuritis; cardiac, vascular, and renal changes, to demand careful inquiry on our part.

The etiological relation of tonsillar and sinus infections in these conditions has been so clearly demonstrated that appropriate questions should appear on all blanks bringing out full information bearing upon the subject. At least one question should appear on every application blank covering any symp-

toms or illness attributed to infection from the teeth, tonsils, sinuses or intestinal tract.

Examiners should be instructed not only to make the necessary inquiry covered by the questions but examine the applicant thoroughly with a view to the discovery of such conditions where the histories are withheld by applicants. Once the fact has been established that the applicant has at any time suffered from focal infection, the result of a local focus of infection, most searching inquiry should be made covering all details, especially as to whether the original focus of infection has been removed, with date of such removal. Statements from attending physicians and surgeons should invariably be required, giving dates and duration of all symptoms, and details of operative procedures for their cure. Before such cases can with safety be accepted, it is essential that the primary focus of infection be removed and that adequate time elapse to assure against the existence of any remaining focal infection.

Many of the troublesome life insurance problems in connection with the intermittent presence of albumen, casts and blood cells in the urine, may be found to be due to infection, as the study of the subject progresses. Billings's observations referred to, certainly point to this, and we should have it in mind in passing upon questionable renal cases. The removal of the primary focus of infection in the milder types of infectious nephritis may, after a reasonable time, render the applicant acceptable for life insurance.

The relation of focal infection as an etiological factor in gastric and duodenal ulcer, cholecystitis and appendicitis should be kept in mind both by the Examiner in propounding his questions and the Medical Director in reviewing the Examiner's report, and whenever necessary the aid both of the bacteriologist and roentgenologist should be obtained and reports from the various specialists required.

The commendable suggestion of Dr. Bradshaw that the Examiner endeavor to arrange for necessary treatment to eradicate the infection, will meet with practical difficulties but

the attempt should invariably be made. One difficulty in its accomplishment is well brought out in the quotation from Dr. Thayer, bearing upon the delicate character of some of the surgical procedures, such as those for removal of adherent tonsils or ethmoidal infection. This need not militate, however, against the endeavor to accomplish results through our Examiners, both in clearing cases for insurance and educating the public.

In conclusion I would urge the adoption of appropriate question or questions covering this important subject, in order to have a clear up-to-date knowledge of infection in its relation to Life Insurance.

Dr. Gordon Wilson—Mr. President and Gentlemen: In 1911, I read a paper on "The Treatment of the Portal of Entry in Systemic Diseases," and attempted to review the literature. I was staggered by the size of it and, strange to say, the best article published up to that date, and I still think the best article, was read in 1875, in this city, an article by Dr. J. W. Riggs, of Harvard. In that paper, he cited a case of arthritis in a young girl with evident iritis, although not definitely named, who, by the removal of the pyorrhœa, extraction of the necessary teeth, and cleaning up of the mouth, had been enabled to return once more to work, or at least was able to walk around, and regained her eyesight. At the end of the paper, Dr. Riggs remarked, "The popular idea is that bad teeth are the signs of old age. A more correct interpretation would be that the signs of old age are probably the results of bad teeth."

In 1881, the Collective Investigation of the British Medical Association showed that about 28% of acute articular rheumatisms were immediately preceded by inflammation of the throat. The number reported I think was close to 700. Reports of St. Bartholomew's Hospital in London, as reported by Olston, showed a percentage of over 50 with one attack of acute articular rheumatism followed by valvular disease of the heart (not cardiac but valvular disease), two attacks up to 60, and three attacks, something over 70. While in children, one

attack of either chorea or inflammatory rheumatism is followed by 75 of valvular lesions of the heart. Now we know to-day that valvular lesions are only a percentage of the heart involvements in these two diseases, and we know that many cases of carditis or myocarditis showing themselves in the age period after 40 have been examined by competent observers and have been sound, as far as a heart lesion could be laid out, so that undoubtedly the question of cardiac lesions in acute inflammatory rheumatism is far higher than we to-day realize, and instead of saying that endocarditis is a complication of acute inflammatory rheumatism, in modern teaching we speak of carditis which includes all three of the structures that go to make up the heart.

In a paper by George B. Wood, of Philadelphia, in 1908, he referred to 108 cases where, preceding inflammatory conditions of the body there was an inflammation of the upper respiratory tract, generally the tonsils. He reported cases of endocarditis and nephritis, even peritonitis.

One of the cases that I reported in my paper, and which was the cause of my writing the paper, was the case of a nurse who had a moderate inflammation of the throat, epidemic at the hospital at which she nursed. After she recovered from that she developed a complication of general peritonitis, she was operated upon, and careful search was made for a local focus of infection within the peritoneal cavity. None was found. It was on account of that case, and also because of the cases of acute inflammatory rheumatism that I used the term "portal of entry" rather than "focus of infection," and I think that is better. We know that in many of these cases of inflammatory rheumatism, the tonsil, just prior to the attack, is reddened, the throat heals and leaves no evidence whatsoever of a focus of infection, and a second attack comes. I have had under observation recently a very interesting case, a young child whom I had occasion to examine very carefully just prior to its going away for the summer. The mother was a little bit nervous, and I went over the child with unusual care. The child had had a cold, and then became quite nervous. On returning to the city,

the child seemed pretty well, but had an attack of green apple stomach, and I was sent for. I went over the abdomen and over the heart. The mother spoke about how nervous the child was, and I realized that I had overlooked a chorea, went back over the case, found the heart to have a soft systolic murmur, a little enlarged, accentuation of the second pulmonic. The child was put to bed for three weeks. Suddenly I was called over on account of a temperature of 102. Routine examination showed general redness of the pharynx, no increased pulse rate, no enlargement of the heart. Temperature came down to 100 after three days, no sore throat complained of. Suddenly there was another sharp rise in temperature, accompanied by a distinct dilatation of the heart, with a pulse rate up to 140, and temperature of 102. No question about an endocarditis. There was a typical case of a Reëntrance of the organism through the portal of entry which had been apparently normal. John Howland is too well known to us all to doubt his ability to judge a normal tonsil. He advised operation on that tonsil, not because the tonsil itself was abnormal, but because there had entered through that apparently normal tonsil an organism causing endocarditis.

Greaves, in 1911, called attention to focal abscesses in their apparent causal relations to arthritis deformans and because of his paper, more especially on account of the work of Billings, there ensued what might be called the massacre of the teeth, and many a man lost his teeth on account of rarefaction around the apex. Certain series of cases, however, began to cause doubt, namely, where a series of X-Rays made at intervals of a year showed no increase in that area of rarefaction. In the paper to which I refer I had reported two cases, other treatments being instituted to relieve a fever, the fever had been relieved by the cleaning up of the pyorrhœal condition of the mouth, and it was on that account that I studied Dr. Riggs's work.

I think Dr. Bradshaw's paper is a most valuable contribution to our knowledge of focal infections, or rather portal infections, and from a life insurance standpoint I think we can look

upon that portal for the entry of systemic diseases of chronic character, characterized by a tendency to complications, as the tonsil, and when we find that our applicant has had his tonsils removed, whether by a poor man or whether dissected by the newest methods, we can still give him the benefit of that operation, assigning him in our numerical method a counterbalance for his one or even two attacks of rheumatic fever, recognizing that although he has no enlargement of the heart, he probably has some areas of fibrosis in the myocardium that are going to show up later on.

Dr. MacKenzie—Mr. President and Gentlemen: I read with a great deal of interest indeed this paper of Dr. Bradshaw's on Focal Infections, and I feel that we are indebted to him for bringing something before us that, so far as my recollection serves me, has not been presented to this Association previously. I think we will all have to agree with the doctor as to the seriousness of these infections, and the necessity of recognizing them, as far as possible. Unfortunately they are not all recognized, and I have a very strong feeling that our examiners in perhaps the majority of cases are not really capable of recognizing them. We know that there are a great many concealed foci that may run along for a long time and produce no symptoms. Dr. Bradshaw seemed to me to indicate that we should not assume risks on these cases until such time as the focus of infection had been thoroughly eradicated. It appears to me that if we take such a stand we would do a good many cases a distinct injustice by declining them, and in so doing would also do our companies some injustice. He mentions the admissions to Bellevue Hospital which appear to me to show that illnesses as the result of these focal infections were materially decreasing, through the better understanding of them, their more frequent recognition, and the more efficient treatment employed to overcome them. The experience in the Industrial Department of the Prudential shows that, in 1910, the mortality from acute rheumatism per two hundred thousand cases, was one per cent; in 1918, it dropped to 4%. That represents a material drop. The mortality statistics of the

Registration Area for the United States from 1910 to 1918 show that the mortality per hundred thousand from acute articular rheumatism had dropped from 6.8% to 3.2%, which further bears out the figures shown by Dr. Bradshaw in his paper, and also the mortality experience of the Prudential. It seemed to me, after I had read Dr. Bradshaw's paper, that I had learned a great deal about focal infections, but I had a feeling that if we went as far as the doctor suggested going, we would be doing some injustice. I do not believe that our examiners could detect many of these concealed foci. Dentists do not do it in their work without special diagnostic methods in a great many instances. Given an applicant with normal looking throat and gums, but with a history of acute articular rheumatism, one attack, no symptoms since, what are we to do with him? I think we can conclude that there probably has been a focus of infection or he would not have had the rheumatism, but are we to postpone him until complete eradication of the focus has been effected, or are we to take him after the lapse of a reasonable length of time—I think most companies put this at one year. The fact that the tonsil has been removed does not seem to me to guarantee us against the possibility of the focus being left, and to be sure of a really thorough eradication would involve an operation by a very capable specialist. To insist on that is going pretty far in our work.

I have certainly enjoyed reading Dr. Bradshaw's paper but personally feel that we can be a little more lenient, in accepting cases with a history of rheumatism or chorea or other impairments suggestive of a focal infection, than is suggested by the doctor.

Dr. Martin—Mr. President and Gentlemen: This very useful paper of Dr. Bradshaw's and the very comprehensive contributions during the discussions have left my task very light.

I think everybody is in accord with the view that when people have a recurrent affection of the throat, they are not very good standard risks for insurance. There is no doubt

about it, that a recurrent affection of the throat implies an increasing liability to infection of the myocardium and infection of the kidneys, so that there can be no question that such risks are sub-standard. If one of the tonsils are removed, provided that has been proven to be the source of infection, then the cases are more easily considered, the liability of infection being less, but inasmuch as so much has been said or read, favoring caution with reference to life insurance where focal infections exist, I might spend two or three minutes in taking the other side.

It is of course obvious to everybody that dental abscesses are extremely common without producing any symptoms. It is also a well-recognized fact that dental experts themselves are unable, from the ordinary symptoms or the ordinary signs, to diagnose such abscesses in very many instances, and it is for that reason that dentists require skiagraphs of the teeth in order that their diagnosis may be aided. Were we to take a census of the possible dental abscesses in this room which might yield positive results with the X-Ray, I think we might be surprised at the large number and yet perhaps there might be no other cause for which life insurance should be refused.

Now the same holds true, I think, in many cases of tonsil infection. As we all know, submerged tonsils may contain infections which are not visible to the eye of the practitioner, indeed they are often not visible to laryngoscopic inspection, and it is only when they have been removed and incised that the enclosed abscess is evident. Under those circumstances it seems difficult to expect too much of the examiner in the case. Perhaps we are apt to overdo the focal infection theory. I do not wish for a moment to minimize it. I think it is extremely important. But I recall, among other instances, one in which a patient with a slight amount of temperature and a slightly rapid pulse had been examined with a view to finding a focal infection, and had been told that a focal infection existed. The skiagrams of the teeth and of the sinuses revealed nothing. She later went to a prominent surgeon in the western part of the world and had the appendix removed, because that might

be the source of infection, and failing that, the gall bladder was removed, and after a while she returned to her home with the same temperature and the same rapid pulse, and obvious signs of exophthalmic goitre. It seems to me we are sometimes liable to overdo the question of focal infection. I think it is difficult, beyond laying down some rules for the obvious cases, to discuss this in relation to life insurance, but I do think a great field for this work on focal infection exists with those who are interested in life conservation insurance.

Dr. L. D. Chapin—Mr. President and Gentlemen: Dr. Bradshaw's paper is a timely one. Focal Infection has come to be an important consideration in medical selection, and the writer deserves our gratitude for his clear exposition of the whole subject. Dr. Lambert's figures, quoted in the paper, on the incidence of rheumatic fever in Bellevue Hospital, are very striking, and the marked reduction in the number of cases in recent years is probably correctly ascribed to the crusade against tonsils and teeth and other foci of infection. I have been particularly interested in focal infection of the kidney, and have wondered whether many of the cases of simple albuminuria which we run across in apparently healthy applicants for insurance may not be due to this condition. Endocarditis is sometimes surely a manifestation of focal infection, and I believe that in certain cases cardiac arrhythmia can be traced to this cause. The subject is so new that it has been difficult to find statistics indicating the importance of focal infection in one work. I agree heartily, however, with Dr. Bradshaw, that our usual action in cases with a history of systemic disease of the focal infection type has been wrong. Before the significance of focal infection was realized, it was a practical rule to postpone a case with a history of rheumatic fever, for example, for say a year after the attack, and to accept it at the end of the year if there had been no recurrence. In the light of our present knowledge this is not good selection. The case should not be accepted after any period of time if the obvious source of infection is allowed to remain in the body.

CLOSING DISCUSSION

Dr. Bradshaw—Mr. President and Gentlemen: The discussion here is similar to a discussion of this topic before a medical society of active practitioners. There are positive and negative factors. I think they are both right. To my mind the importance of the subject lies in the borderline and appeal cases. If fifty of us were to examine a questionable heart-murmur, twenty-five would probably say, organic, and twenty-five, non-organic. If the applicant had a mouthful of bad teeth or very bad tonsils, we would all lean to the side of organic heart disease, at least we would give our companies the benefit of the doubt. It is so in cases of recent digestive disorders. A man has a vague indigestion, two or three attacks, nothing positive. It might be gall bladder. It might be appendix. If no visible foci of infection are found, we give the man the benefit of the doubt; on the other hand, if he had bad teeth, organic disease in the abdomen is very probable. I have looked over our medical blanks, and I do not find there any definite question bringing this out, excepting in one or two. I agree with Dr. Porter that it might be advisable to have a question on the examination side of the blank as to whether the examiner could find any visible focus of infection, either of recent origin, or, one that had been there for some time. Dr. Weisse has cited a standard case. I think we could all cite similar cases. I agree with Dr. Wilson that probably the tonsils account for the greatest amount of infection, and their removal frequently clears up a condition, and that condition remains cleared up, and we ought to give such an individual the benefit of the doubt. Dr. MacKenzie is perfectly right, there are certain cases in which you cannot put your finger on anything that is definite, and those cases have been accepted for years, even with bad teeth in their mouths, or enlarged tonsils. If they have had no recent evidence that leads you to think that they had systemic disease, I see no reason why we should not keep on with our present procedure, and take them as they come along. If they have had some recent disease due

to what is now known as a focus of infection, I think they ought to be pretty carefully gone over, before the decision is made. There is no question that the average examiner cannot recognize foci of infection. The average examiner does not know how to take blood pressure properly. I think it will be our duty to educate him, as well as to educate the applicant. It's coming and we may as well get in line for it.

The negative evidence that Dr. Martin brings up is very true. Not every person gets cirrhosis of the liver because he takes a certain amount of alcohol regularly, and certainly a great many people have very bad mouths or chronic sinuses, or other conditions, who seem to enjoy perfect health. We still have to take them as we have taken them right along. The form of the question on the blank will be left to each one of us to decide. I would like to see it there, and I would like to have the assistance of that evidence in deciding on borderline cases.

The President announced the appointment of the following Committees, in accordance with the resolutions adopted by the Association on the preceding day:

A Committee with authority appointed by the chair to take up the question of reporting deaths, with cause, to hospitals, clinics and surgeons, who have operated upon the risk, as shown by death claims.

DR. HOMER GAGE, *Chairman*,
Dr. EDWIN W. DWIGHT,
DR. HARRY TOULMIN.

A permanent Committee of Five to be known as the Public Health Committee of the Association of Life Insurance Medical Directors, this Committee to establish relations with all of the known organiza-

tions who have for their purpose the protection of the health of the American people:

DR. THOMAS H. WILLARD, *Chairman*,
DR. FRANKLIN C. WELLS,
DR. FRANK L. GROSVENOR,
DR. BRANDRETH SYMONDS,
DR. OSCAR H. ROGERS.

Dr. G. C. Strathy, Assistant Medical Director of the Canada Life Assurance Company read the following paper:

FURTHER EXPERIENCE IN ESTIMATING THE EFFECT OF MILITARY SERVICE ON INSURANCE RISKS.

By G. C. Strathy, M.D.

Assistant Medical Director, Canada Life Assurance Company.

The Canada Life last spring undertook to present the Canadian experience of the result of military service on insurance risks. The Canadian Pensions Board were communicated with and promised to supply us with the necessary official data. Unfortunately they have been unable to do so and for statistics we had to fall back on the Department of Militia and Defense and the Department of Soldiers Civil Reëstablishment at a late moment.

Most of the statistics of the Medical Services have been in the hands of the officer in charge of records for some weeks so we were unable to have access to them. Consequently we have tried to make good the deficiency by help from three sources. They are (1) a few statistics obtained from the Departments of Militia and Defense and Soldiers Civil Reëstablishment; (2) the personal experiences of medical men in charge of various

Soldiers Civil Reëstablishment clinics; (3) the British, Canadian, and French medical literature of the past year. From these we hope to be able to present not a mass of useful statistics but a considerable amount of useful opinions which may to some extent point out the pitfalls in selection and the consolidated opinion of well-trained men who have had many years of experience in diseases of the war.

The following table shows the main causes of admission to hospital and of mortality in the Canadian Army overseas during the war.

TABLE I.

Disease	Admission to Hospital	Deaths
Wounded and Gassed	144,606	55,951
Cerebro-Spinal Meningitis	399	219
Diphtheria	1,700	18
Enteric Fever	422	16
Paretyphoid A & B	358	7
Scarlet Fever	271	4
Measles	2,816	30
German Measles	2,641	3
Influenza	45,954	776
Mumps	9,643	0
Dysentery	1,500	13
Malaria	550	6
Pyrexi of Uncertain Origin (Mostly French Fever)	15,353	4
Trench Fever	2,997	0
Erysipelas	252	6
Inflammation of Connective Tissues (Boils, abscesses, cellulitis, etc.)	6,823	13
Tetanus	31	7
Endocarditis	133	30
Pneumonia	4,771	1,194
Rheumatic Fever	1,258	2
Tonsillitis	10,461	2
Tuberculosis of Lungs	3,117	174
Tuberculosis of other organs	298	37
Gonorrhœa	47,471	1
Syphilis	18,612	0
Trench Feet	1,330	2
Insanity	1,603	0

TABLE II. is a summary of the Canadian casualties and sick.

Total forces overseas	Approx.	400,000
Wounded or gassed		144,606
Killed, died of wounds or gassing		55,951
Sick, not wounded, admitted to hospital (including re-admissions)		395,084
Died of Disease		3,871

TABLE III.

Total forces		400,000
Total deaths		59,822
Percentage of deaths	Approx.	15

It would be impossible in the time allowed to analyze all these main causes of disease and death in relation to their after effects. Therefore only the seven most important will be considered. They are gunshot wounds, gassing, trench fever, trench nephritis, shell shock, and nervous disorders, functional heart disorders (in the army nomenclature D. A. H.), syphilis, and tuberculosis.

Gunshot Wounds

Gunshot wounds will have to be considered under five heads (*a*) G. S. W. penetrating or fracturing the skull; (*b*) G. S. W. penetrating the chest; (*c*) G. S.W. penetrating the abdominal cavity; (*d*) G. S. W. leading to amputation of an extremity; (*e*) G. S. W. fracturing other bones.

One of the main considerations in G. S. W.'s is whether the missile is retained or not. Dr. C. L. Starr, consultant in Orthopedic Surgery of the C. E. F. says that it has been a frequent occurrence in the past two years for infection to recur in old wounds where the missile is retained. This is, however, the exception rather than the rule but the importance of such a possibility naturally depends on the location of the missile. Recurring infection is seldom a danger *per se* because the infection is seldom virulent, but a recurrent infection in the chest or skull would naturally be serious, in a limb or superficial area of minor importance.

(*a*) G. S. W. with fractured skull. The consensus of opinion of all authorities is that G. S. W.'s where the missile entered the skull but especially where the meninges were pierced are of too grave import to be insurable. Applicants whose skulls were fractured but not depressed but who had intradural hemorrhages should be postponed for three years as probation for Jacksonian epilepsy and are then probably standard risks unless the hemorrhage was severe.

(*b*) G. S. W.'s penetrating the chest. Where the missile is not retained and empyæma did not follow the risks are acceptable at standard rates unless there are physical signs of the lung function being diminished. Where the foreign body is retained without history of infection the risk is slightly substandard. Where an empyema has followed a retained missile the risk is certainly greater. Where empyema has followed but the missile is not retained the risk should be judged somewhat as an empyema following pneumonia would be judged, *i.e.*, by the amount of damage of lung function resulting. There is, however, less chance of tuberculosis following than where empyæma has followed pneumonia. J. H. McDougall followed up a number of cases of old lung wounds who had been discharged from the army as disabled (and therefore the most severe type) and he found that nearly all were unable to do heavy work. Emphysema and purulent bronchitis were frequent sequelæ but tuberculosis was rare. Retained missiles where present had caused no symptoms in 20% but in most cases purulent bronchitis or hæmoptysis had followed. Following empyæma the movement of the lung was restricted and dullness persisted but these were the more severe cases and were examined within a year of discharge. Abscess and gangrene were rare. On the other hand Dr. Norman Shenstone, with a large number of discharged surgical cases under his care, has seen no empyema in the last year and has not seen any cases where retained missiles demanded surgical attention. Dr. Shenstone sees all the surgical cases of Department of Soldiers Civil Reëstablishment in the Toronto area where there are 70,000 discharged soldiers. Broadly it can be stated that

where no missile remains and infection has not resulted the risk is standard. Where infection has followed two years' freedom from infection should be demanded and the risk then judged as an empyema following pneumonia.

(*c*) G. S. W.'s of the abdomen. In the abdomen retained missiles are rare but constitute a fairly serious impairment when present. The risk must be judged according to the nature of the injury and the impairment of function which follow.

(*d*) G. S. W.'s leading to amputation of an extremity. Dr. Starr's experience is that osteomyelitis within two years of infected fracture is fairly common and therefore a probation of that length should follow. The Canadian Companies have drawn up a schedule in healed amputation cases which is thought to err on the side of leniency but which they generally follow. It is as follows:

Amputations of the arm at or near the shoulder joint	125%
Amputations of the arm above the wrist and well below the shoulder	115%
Amputations of the leg below the knee	115%
Amputations above the knee below the upper third of the thigh	125%
Amputations at the hip joint or in the upper third of the thigh	135%

The Total Disability Clause is not allowed in any of these cases.

(*e*) G. S. W.'s with septic fracture of large bones, are believed to be acceptable at standard rates where there is a fair functional result and there has been no sepsis for two years. Dr. Starr's opinions are here recorded.

"While it is very difficult to give answers to most of your questions still I am writing a few of my impressions on the things which you suggest.

"*Amputations:*

"I feel sure that in the bulk of the amputations of the smaller limbs, such as, the forearm and the leg close to the ankle, the effect is slight on longevity. In the amputations of the upper extremity, close to the shoulder, I am quite sure

that it has a definite effect. The amputations of the upper part of the thigh, especially at the hip, there is no question but that it is a very marked factor in shortening the life of the individual. There is in addition the factor of possible injuries to these people so disabled.

"*Osteomyelitis:*

"In cases of bone sepsis there is no question but that recurrences may take place many years after the wound is entirely healed, possibly five or six or even up to ten or twelve years. There are very few deaths up to the present time from bone sepsis of later stages but there is no question but that it has a distinct effect in the production of amyloid changes in the internal organs.

"*Abdominal Wounds:*

"The wounds of the abdomen, such as union of the bowel after excision, or gunshot wounds and similar types of injuries, these apparently give very little trouble after they have been healed for a short time, and I have seen no bad after effects.

"*Chest Wounds:*

"Cases of chest wounds followed by empyema, these have a constant tendency to recur, and we see many of them recurring many months after the wound has primarily healed. I should feel that they could not be considered permanent for five or six years.

"*Gunshot Wounds of the Head:*

"Cases of gunshot wounds of the head undoubtedly complain of dizziness for years after their injury. These factors are probably not more than one sees in the ordinary run of war conditions, such as neurasthenia, etc. The probability of danger from epilepsy or bone abscess is, in my opinion, very slight after the third year."

RISKS FOLLOWING GASSING

The consensus of French opinion in these cases is fairly expressed by Mallie who states that chlorine and yperite or mustard gases are the only ones that have much tendency to

cause permanent danger to the lungs. Chlorine gas was not used after 1916 but hundreds of thousands of men were more or less affected by yperite in 1917 and 1918. He states that this gas may cause a permanent lowered resistance of the lungs due to scarring of the mucosa which affects respiratory interchange. The lesions may be progressive and may lead to changes in other parts of the body. He states that "a burn of the mucosa of the lungs cannot be considered cured after the scar has been formed as the full consequence may not appear until a long time after the scar has been formed. Consequences are especially severe in those with a previous pulmonary weakness." The sequelæ he found were emphysema, congestion and pseudo-tuberculosis. He is in agreement with all writers when he says it is very doubtful if gas poisoning ever activates an old tuberculosis.

Clerc, Ramond, and Guilhaume describe the results in 441 cases of "Mustard Gas" poisoning. It must be understood that their results deal with severe cases only. The great majority of slightly gassed patients were practically well in three weeks although many suffered from nervousness for some months and a long stay in hospital was often due to the nervous condition. Of the 441 cases 162 presented permanent disorders about a year later, 27 suffered from attacks of simple relapsing bronchitis, 30 showed bronchitis and emphysema, 21 suffered from "relapsing œdematous congestion" with slight fever and expectoration, 7 did develop pulmonary abscesses, 17 showed "pseudo-tuberculosis" loss of weight, bronchitis and subcrepitant rales at the apices. These symptoms usually lasted 4 or 5 months but tubercle bacilli were not present in the sputum and the lesions were not progressive. Only 2 of the 441 cases had developed tuberculosis.

Achard has reported the results in 2958 mustard gas poisonings and 567 who had been poisoned by chlorine. He found that permanent damage, especially decreased expiratory exchange, was relatively much more common in the latter class. Tuberculosis did not develop more frequently than in those who had not been gassed but he thinks that gas poisoning may

activate a latent lesion. Some cases of "pseudo-tuberculosis" developed but the sputum was negative for tubercle bacilli and the X-ray findings differed from cases of tuberculosis.

The British Chemical Warfare Medical Committee in their report state that the ill effects of mustard gas poisoning reach their maximum in the first two or three days and after that the resulting anoxæmia does not prove fatal. Serious late results of chlorine gas they believe are proportionately much more common and pulmonary sclerosis may follow. The late results of mustard gas poisoning they found to be largely symptoms of nervous exhaustion. McNee who had a large experience in France agrees with their findings.

S. O. Cowen and Dennis reported their experience with Australian soldiers arriving in Australia a year or more after being gassed. They examined 150 such cases and found cough, expectoration, dyspnœa, palpitation and loss of weight. Cowen believed that dullness over the right intrascapular region was common. Only three showed emphysema and six showed fine sibilant rhonchi. Nearly all improved on return to civil life. He appears to lay too much stress on subjective symptoms which are so common in tired soldiers. Dennis examined the same cases radioscopically and found no gross lesions but slightly diminished translucency of the lungs and the hilus shadows more marked than usual.

Dr. A. H. W. Caulfield has had a large experience in chest disorders of returned soldiers. He is in charge of the Chest Clinic of the Department of Soldiers Civil Reëstablishment of the Toronto area. His opinion is, "I feel that, considering the large numbers severely exposed, complete recoveries must have followed in a very high percentage of cases. I am left with the impression that those now suffering from chronic bronchitis or bronchiectasis with marked signs and symptoms either had considerable tendency to chronic bronchitis before the gassing or developed the condition during their hospitalization for the gassing or soon after their exposure. I believe where no clinical signs are now present in the chest the cases may be regarded as standard risks for life insurance." Dr.

Caulfield's opinion is in agreement with my own. It must not be forgotten that the epidemic of influenza with its frequent lung sequelæ occurred with and followed the incidence of gas poisoning and is partly to blame for the lung complications which were found in gassed soldiers.

TRENCH FEVER

There are no reports in the literature of any permanent effects from this disease but many men showed circulatory symptoms and debility for months and even years after their attack and many of the low blood pressures which are so common in ex-soldiers are probably due to trench fever. Towards the end of the war there was a growing opinion that war nephritis and trench fever were closely allied and a statistical study of the incidence of these two diseases certainly tends to corroborate the opinion that if nephritis was not a complication of trench fever it was probably transmitted by the same agent, namely the louse.

WAR NEPHRITIS

Amongst those who studied war nephritis in its early stages there was an almost unanimous opinion that it was not the same disease as acute nephritis of civil practice. Some of those who have seen war nephritis only in the later stages can see no difference between them. This question is of considerable importance in applicants for insurance for it has been generally held that the prognosis in war nephritis is much better than in civil nephritis. Certainly in the acute stages of the former the kidneys seemed to be very much less damaged than one usually finds in the latter. Oliguria and blood casts were not permanent symptoms and many cases appeared to be cases of hæmaturia from the lower urinary tract rather than nephritis. Recovery from acute symptoms was very rapid and the disease seemed to terminate by crisis. The mortality in the British army was only 2% in the first six months in 25,000 cases which occurred. This is a much lower mortality than in civil nephritis.

Toennissen reported the results at the end of a year on 254 German cases of war nephritis. Of these 68% appeared to be absolutely well in from six weeks to two months. The average time of complete recovery was four months. High blood pressure lasted only a few days. In 12% all subjective and objective symptoms, except albuminuria, had disappeared. He found the ability to excrete water diminished, the blood area increased, and the ability to concentrate decreased. He found chronic nephritis resulted in 13% of all cases. The blood pressure in these cases was usually increased. His mortality at the end of four months was 3%. He believes the prognosis is worse in case of long duration and that the severity of symptoms at the height of the attack has no bearing on prognosis. He also believes that if the blood pressure or urea in the blood are increased at the end of six months the outlook is unfavorable. Schutz and Reitler, in 1916, tested with functional tests 100 men who had been considered cured of nephritis some months previously. Only 5% showed a normal function but as 100 men who had never had nephritis showed almost the same results their gloomy view of the prognosis is hardly justified.

It is impossible to obtain British and Canadian statistics at present. There were about 25,000 cases of nephritis in the British army of 5,000,000 men and the proportion in the Canadian army was about the same. In this 25,000 a large number should more properly have been called cases of albuminuria. Wilson tested 50,000 men at a British base before going up to the front and found albuminuria in 6%. In 2% casts were also found and he believes that about 2% of all men of army age have a slight degree of nephritis before going to the front. He also examined 10,000 men at Aldershot shortly after enlistment and obtained almost the same results. The British mortality for nephritis before discharge from the army was 2%. The Canadian mortality was about the same.

McCordick and Robins analyzed 87 cases of nephritis returned to Canada. In 3 cases it had occurred as a complication of other diseases, in 7 cases there was a history of a

previous attack before enlistment, 9 of the cases had never been to France so that only 68 of the 87 cases (78%) were true cases of war nephritis.

The problems of war nephritis from an insurance standpoint are three:

(1) Did the applicant suffer from true war nephritis, ordinary nephritis, or albuminuria without nephritis?

(2) Is the nephritis cured?

(3) If the lesion is healed, to what extent is the normal function of the kidney impaired?

(1) To decide the question it should be understood that a history of a previous attack of nephritis or a history of nephritis following another disease, trench fever excepted, would lead one to believe that the attack was probably not one of war nephritis. If the attack was of short duration or accompanied by marked hæmaturia it was probably war nephritis. Albuminuria apart from nephritis was usually discovered on routine examination while in hospital and was unaccompanied by subjective symptoms. Dixon while in charge of the medical ward of a Corps Rest Station found that 22% of all his patients showed albuminuria on admission. Nearly all had had trench fever or were very verminous and had furunculosis as a result and in nearly all cases the albuminuria cleared up in a few weeks. If a medical officer was not cognizant of the frequency of albuminuria in front line troops he was very apt to diagnose many cases showing albuminuria as nephritis and send them to hospital diagnosed as such. This could partly account for the large number of cases diagnosed nephritis and also for the very favorable mortality rate.

(2) If the applicant was discharged from hospital with urine normal, and this would only be done after repeated analyses showed no albumen or casts, and the urine was normal on every examination for the next two years it would appear reasonable to suppose that the kidney lesions were healed.

(3) If the kidney is damaged to such an extent as to inter-

fere with functional efficiency, and yet the urine is free from albumin and casts, increased blood pressure and cardiac hypertrophy will follow after an interval varying with the severity of the functional impairment. There are many functional tests of the kidney which might aid in deciding this question but it is very seldom possible in life insurance examinations to make these tests.

Taking into consideration the findings and opinions of various observers it is suggested: (1) That where the attack was short and the urine was free from albumin in less than six months an applicant with a history of war nephritis is acceptable at standard rates after a probation of two years when the urine, blood pressure and heart are normal. (2) When albuminuria persisted for over six months after an attack of war nephritis it is probable that the risk is sub-standard. The extra mortality must be judged by the features of the convalescence and the present condition. (3) Applicants with a history of war nephritis who show cardiac enlargement, increased blood pressure, albuminuria, casts in the urine or low urinary specific gravity are only insurable with a heavy loading of the risk in the best class and must usually be considered as uninsurable.

(4) Functional tests of the kidney made two years after the attack are of great value but seldom obtainable.

(5) Attacks of nephritis which occurred before the applicant reached the war area, *i.e.*, before he became verminous, are very likely not to have been attacks of war nephritis and should be regarded more seriously.

NERVOUS DISORDERS

To obtain a proper insurance viewpoint of the nervous disorders of warfare one should appreciate the various types of individuals who were affected by them and the various ways in which they were affected. Each type should be considered separately. Roughly they may be divided into four types, viz.:
(1) Individuals of average or above average nervous stability.
(2) Individuals with imbalance of the sympathetic nervous

system or as some would call it endocrine imbalance. (3) Individuals of low nervous stability, *i.e.*, the so-called neurasthenics, hysterics and (4) potential insane and epileptic individuals.

Type (1). Individuals of average or better than average nervous stability only developed nervous disorders after extreme nervous shocks. One boy of 19 fell 12,000 feet in a burning aeroplane. Naturally his nerves were upset for some months. He is now normal. Others collapsed after many months of terrific infantry fighting. This class nearly all returned to normal after a few months' rest.

Type (2). After varying degrees of exposure to nervous strain broke down with symptoms of sympathetic origin such as rapid hearts, nervous vomiting, tremors, sleeplessness and enuresis. They recovered fairly rapidly after rest but especially after the armistice.

Type (3). Include most of the so-called shell shocks. After very little exposure during which they frequently performed deeds of marked bravery they suffered from melancholia, hysterical fits, hysterical paralysis, aphonia and complete "nervous breakdown." There was frequently a history of nervous instability in the family. Recovery in these cases has been slow. They show inability to work and constitute most of the "unemployable old soldier" class.

Type (4). The potential insane and epileptics formed a larger proportion of the British and Canadian armies on account of the conditions of recruiting under voluntary enlistment which obtained in the first three years of the war. The United States had more time to raise their army and had the advantage of the experience of the British Empire. Consequently their army was more carefully selected. This type broke down easily under the strain of service. Colin of Paris from his experience believes that the strain of service caused rapid development of general paresis. Schroder from his large experience with epileptics in the German army concludes that war strain was not a cause of epilepsy but that hysterical soldiers were very subject to epileptoid attacks. Most of the

cases of malingering occurred in individuals of types (3) and (4).

Applicants of types (1) and (2) may be accepted as normal risks if they are now normal. Applicants of type (3) may be judged as neurasthenic and hysterics who have had a nervous breakdown. They are probably more liable to suicide and insanity, should not be allowed a total disability clause and are as a rule slightly below standard (4). Type (4) are not safely insurable.

Here is given the opinion of Dr. R. G. Armour who has been in charge of the nervous cases in the Toronto area. He has had a large experience of nervous cases extending over five years.

"Your letter of the 3d inst. has interested me very much because I am frequently told by men reporting for the B. P. C. that they have been refused for insurance while they appear to me to be good risks.

"I can say that there are many who were diagnosed 'Shell Shock' overseas who are steadily improving, and who will unquestionably live the ordinary time and remain sane and wage earning.

"Perhaps the best way for me to speak of them is to quote a rough classification which I have used since about the end of 1915, and which I have had no occasion to change, except as an odd case might require an elaboration of the classification.

"(1) High-type individuals who have been in close proximity to exploding shells and especially those who have been thus caught in buildings or dug-outs, who have probably suffered an actual commoto cerebri, and their symptoms have had an organic basis. I believe that all of those have by now actually cleared up, or have become definitely permanent cases. The latter would not be good risks, and the former would have to be dealt with on their individual merits, on the basis of persistence of symptoms or the existence of organic signs.

"(2) High-type individuals who have carried on in spite of incipient or subacute infections, especially malaria and dysen-

tery. There were many of these cases in Macedonia. Their prognosis depends entirely upon their recovery from the infection. At present most of these cases are low grade infections of tuberculosis, and they may even become progressively worse, developing a toxic-exhaustion psychosis.

"From here to the end, at least theoretically, all cases are of a psychopathic nature, and again they must be judged on their own merits after a very thorough and special examination which takes into account the family history in detail, and an estimate of the man based on his schooling and after life until his enlistment, and also the length of time he was able to perform useful duty at the front. They are chiefly:

"(3) The major psychoses in their incipient forms or during remissions at the time of enlistment. I believe these to be very much more frequent than has been realized. They are chiefly dementia præcox, and manic depressive insanity. I don't think that I am straining the point in making this diagnosis in the cases which I have so classed. They are not anti-social, do not require custodial care, etc., but present in a modified form the actual symptom complex of these two diseases. The general paresis has been overlooked in a large number of cases, or has been subsequently developed.

"(4) The neurosis, such as psychasthenia, hysteria, and neurasthenia carefully dissociated from an organic basis.

"I believe the psychasthenics pure and simple, and the neurasthenics, who are considered otherwise good risks, to be equally good from this point of view provided they are making satisfactory progress.

"The hysterias seem to me to be the greatest problem. Regarding hysteria as a functional disturbance of motion, sensation and mentality, I believe the first two would be good risks if it is carefully determined that they are not also suffering from the early stages of a major psychosis, which is not infrequently the case.

"What I mean by the functional disturbance of mentality is the occurrence of somnambulism, fugues, or alternating personalities. I believe these cases to be very bad risks.

"I have not included in my consideration above any cases who have received any actual injury.

"I believe that the vast majority of cases who are not good risks are not because of the danger of their becoming totally disabled on account of mental deterioration. I do not think that many will die any sooner than the average except in the event of insanity and suicide."

THE EFFECT OF WAR SERVICE ON THE HEART AND BLOOD VESSELS

In the British and Canadian armies all cardiac and circulatory disorders, apart from organic disease such as valvular disease and arteriosclerosis, were classed as D. A. H. or Disordered Action of the Heart. This gave a false impression as to the prevalence of cardiac disease for most cases of D. A. H. were not due to disease of the heart or vessels.

The prominent symptoms in D. A. H. or as Lewis has misnamed it Effect Syndrone were increased pulse rate and vasomotor disturbances. The chief causes were endocrine imbalance due to nervous excitement and the toxic affects of infectious diseases especially trench fever. Increased muscular exercise was not a great factor as many cases were observed in the not overworked personnel of several base hospitals following a bombing raid. The men were largely nervous individuals who for that reason were not employed in dangerous areas. The prognosis of nervous D. A. H.'s has been discussed under nervous disorders and need not be referred to again. They improved rapidly when removed from excitement and especially after the armistice was declared. Very few of these men have any permanent defects following their period of tachycardia but there were possibly included in this class a few cases of hyperthyroidism of slight degree. The greatest harm which has resulted to these men is the fear that they have "weak hearts" but Dr. Leonard Murray who is in charge of the S. C. R. cardiac cases in the Toronto area believes that on the whole these men show more tortuous temporal arteries,

and that many of them have slight permanent damage of the circulatory system. B. M. Watson from his experience with these cases in the British Pensions Board believes no man should receive a pension for D. A. H. But that many so-called D. A. H.'s are suffering from chronic trench fever or slight tuberculosis.

There is an observation frequently made and with which our experience in the Canada Life and my own experience in the Out-Patient Department of the Toronto General Hospital agrees and that is that ex-soldiers very frequently have low systolic and diastolic blood pressures. This is especially marked in men who suffered from trench fever or neuroses of the endocrine imbalance type.

Applicants with a history of cardiac disorder while in the army are safely insurable if no abnormality of the circulatory system is found on examination.

TUBERCULOSIS IN THE ARMY

In the second and third years of the war it was said that tuberculosis was rampant in the Allied armies especially the French. Later this was found to be much exaggerated as it was found that nearly fifty per cent. of the cases diagnosed as tuberculosis were not tuberculous. The statistics of many of the armies are now available. Von Schjerning in the official medical report of the German army shows there was not the slightest sign of an increase of tuberculosis but rather a decrease. In the German navy there was less disease than in peace time but a slight increase in tuberculosis with a slightly higher mortality. This may be accounted for by the fact that their navy being unable to keep the seas the personnel did not get its usual amount of fresh sea air. It is difficult to obtain accurate figures for the British army during the war but it is believed that war service did not cause any increase of tuberculosis. There were about 15,000 cases of pulmonary tuberculosis in the British army at home and abroad.

In the Canadian army 3415 patients were diagnosed as

tuberculous and 211 died of tuberculosis. It must be remembered that the examination on enlistment in the first three years was not strict and many active and latent cases were overlooked.

Dr. C. D. Parfitt who is one of the leading authorities on pulmonary tuberculosis in Canada and who is at present employed by the Department of Soldiers Civil Reëstablishment on a general review and statistical study of tuberculosis in the Canadian army and discharged soldiers has been good enough to supply us with the results of his experience to date. He finds that tuberculosis of the lungs has been much over diagnosed and he believes that the effect of active service has on the whole been protective. Only one third of all patients in S. C. R. Sanataria in Canada show tubercle bacilli in their sputum. He believes that "gas as a predisposing agent is exceptional."

There is a fairly general opinion amongst those qualified to judge that active service does not predispose to tuberculosis but is more probably protective. Tuberculosis was probably over diagnosed in all armies especially following the outbreak of influenza.

VENEREAL DISEASE

From Table I you will notice that there were 47,771 admissions to hospital for gonorrhœa and 18,471 for syphilis. From this it would appear that 11.5% of the C. E. F. had gonorrhœa and 4.5% had syphilis but from these figures must be deducted the readmissions to hospital which were very considerable. Nevertheless the fact remains that venereal disease in the Canadian army was serious for army life was no longer than two or two and a half years on the average and for that period the incidence rate was high, probably nearly double that of the civilian population. On the other hand the treatment was usually very thorough and is still being continued, so that a soldier affected with syphilis was much more efficiently treated than the average civilian. Undiagnosed syphilis, one of the greatest dangers in insurance, was very rare in the army

owing to the education of the soldier on venereal disease and the thorough and frequent inspections.

SUMMARY

The impairments resulting from service are in nearly all cases very apparent on examination. Trench nephritis and syphilis are the great exceptions. From the impairments must be deducted the advantages of many months of healthy exercise, fresh air and well-regulated diet and régime. If he has no objective impairments, the ex-soldier, must be considered an usually good risk for it must be remembered that in early adult life he was carefully examined, found free from serious disease and considered fit to undergo the severe test of active service.

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Dr. Toulmin—Mr. President, I consider this paper one of the most valuable contributions to our meeting.

Dr. Weisse—I am sure that we all take pleasure in agreeing with Dr. Toulmin.

Dr. Rowley has given us a very scholarly paper with reference to some effects of Appendicitis. He draws attention also to the question of focal infection of the appendix as a seat of focal infection, which is of interest in connection with Dr. Bradshaw's paper.

SOME EFFECTS OF APPENDICITIS

By Robert Lee Rowley, M.D.

Medical Director Phœnix Mutual Life Insurance Company, Hartford, Connecticut

In accepting the invitation of President Weisse to prepare a paper for this Meeting, I was impressed with the obligation to the Association to present something that would be worthy of your serious consideration and, although my ambition has fallen short of realization, I make bold to invite your attention to a review of our knowledge of disease of the appendix, and to consider its relation to concurrent and subsequent disease of other organs; to find out if possible, whether or not cases with a history of appendicitis, when applying for insurance, are receiving consideration that is both fair and equitable to them and to the company.

In Volume IV of the Report of the Medico-Actuarial Investigation, the experience there recorded would indicate that a history of appendicitis might be regarded as an asset in an applicant for insurance, for the mortality was found to be better than normal, and particularly in the early policy years. If we could accept that experience as our guide in the selection of risks, the problem would be without further difficulties.

Realizing, therefore, that whatever conclusions are to be reached must be based on information from other sources, I have attempted to learn what may be found in current medical and surgical reports, that may serve as additional guide-posts to steer us in the right course in forming our decisions.

While it is probable that disease of the appendix can boast of quite ancient history, definite recognition did not take place

until the second decade of the nineteenth century, and the application of surgery as a curative measure seems to have been practiced by some of the leading surgeons in the eighties.

In a paper read before the Royal Medical and Chirurgical Society in 1888, Sir Frederick Treves first proposed that in cases of "relapsing typhlitis" the appendix should be removed during the period of quiescence. His proposal was not received very enthusiastically, but as he said in opening the important discussion on appendicitis before the same society in 1905, "Of late years he had no ground for complaint on that head."

From that period to the present, the appendix and its disorders have assumed a position of prominence in both medical and surgical circles that would seem quite sufficient to bring the subject before us.

In the immense amount of literature that has accumulated, one finds but little that has a direct bearing upon the points that most interest us in the selection of lives for insurance. There are, however, a few important studies that should be helpful to a proper understanding of the importance of this disease in its relation to our work.

That appendicitis is one of our most frequently met with surgical diseases is too well known to need further comment. That the mortality directly traceable to this disease has shown a considerable improvement in recent years is readily apparent upon referring to the literature.

Anatomically speaking, the appendix has about the same structure as that of the large intestine, but differs somewhat in its histological relation. The mucous membrane of the appendix, during the earlier years of life, contains an extraordinary number of lymph follicles, thereby resembling somewhat the structural formation of the tonsil. Most important of the anatomical considerations, however, is that of the circulation, which is derived from the superior mesenteric artery, and forms an anastomosis with a feeble and insignificant collateral circulation from the cæcum.

In these anatomic factors it would seem that we have, in

part, at least, an explanation for the relative infrequency of appendicitis in young children. Whatever degree of protection against infection may rightly be attributable to the richness in lymphoid tissue, it appears gradually to be lessened with the involutionary changes in the appendix as adult age is reached, and the period of greatest incidence of the disease, from approximately ages fifteen to thirty, is followed by a progressive decrease until at old age the disease is relatively rare.

A prominent member of the profession is reported to have once answered a layman's inquiry as to the function of the appendix by saying, "It contributes largely to the support of a noble profession."

That appendicitis is an infectious disease, blood borne, seems to be established beyond the shadow of a doubt by the research and experimental work done both in this country and in Europe in the last few years.

Several observers have given detailed descriptions of appendicitis occurring in epidemic form; its seasonal prevalence, and occurrence in members of the same family; its frequent association with well-known infectious diseases as a complication or an early sequel has been frequently noted in the literature.

Rosenow, in the Journal of Infectious Diseases, for April, 1916, reports the study of an epidemic of appendicitis and parotitis in which it was apparent that the causative agent was a streptococcus contained in the dairy product.

A series of observations and experiments on the bacteriology of appendicitis and its production by intravenous injection of streptococci and colon bacilli, reported by Rosenow in the Journal of Infectious Diseases in 1915, indicates that appendicitis, even in the absence of foreign bodies commonly is a hæmatogenous infection, secondary to some distant focus; that it develops when for some reason or other the organisms in the focus, usually streptococci have acquired an elective affinity for the appendix, and at the same time gain entrance into the circulation.

These results bear out Rosenow's theory that the focus of infection is to be looked on, not only as the place of entrance of bacteria, but also as the place where they may acquire the varying affinities necessary to infect distant organs and tissues.

In another article on the elective localization of streptococci, (*Journal American Medical Association*, November 13, 1915), Rosenow gives a comprehensive and descriptive discourse on the affinity or trophism which the streptococci isolated from various diseased structures have for the same organ or tissue when injected into animals. Many animals showed no other lesion than in the organ or tissue from which the streptococci had been taken. The streptococci strains differed only in degree of virulence, those in the gall bladder were found to be more pathogenic than those taken from gastric ulcer, and those taken from the appendix were least virulent. To quote Rosenow, "It appears that the cells of the tissue for which a given strain shows elective affinity take the bacteria out of the circulation as if by a magnet—absorption."

The general systemic distribution of micro-organisms in certain diseases with a localized focus seems well established and, according to Rosenow, the tendency to localize electively within a limited range is most highly developed in the relatively non-virulent strains isolated from chronic lesions.

Since the bacteria which have grown in a given tissue acquire greater affinity for this tissue, the likelihood of these bacteria to involve other structures is relatively slight; hence the secondary focus, appendicitis, for example, would appear to be less important as a distributor of bacteria than is the primary focus.

The result of painstaking and systematic research in the past few years in bringing to light concealed infection has assumed sufficient proportion to mark a new era in scientific medicine and surgery, and without enumerating all of the favorite hiding places for these bacterial invaders, waiting for an opportunity to start trouble in some organ of the body, it is opportune to remind you that the appendix is now known to be one of the organs in which these so-called "outlaw bands" frequently take refuge.

That the infection in appendicitis is secondary to the hæmatogenous invasion of bacteria, and not the result of primary invasion of the infective agent from the lumen of the organ is maintained by several observers.

To quote from Tice's *Practice of Medicine*, Volume I, "Evans found that in 214 cases of acute appendicitis 86% had shown evidences of acute nasal and throat infection on an average of sixteen days prior to the appendicial attack. It was also noted at eight periods during the six years of these observations that there were marked increases above the expectant rate, which evidenced an epidemic type of the disease, and indicated a wide-spread infection with organisms having a special tissue affinity for the appendix. During such periods appendicitis occurred from four to fifteen times above the expectant rate, and the interval between the nasal and throat infection and the appendicitis was on an average of eight, instead of sixteen, days.

With such evidence as we now have pointing to appendicitis as a focal infection, it is not altogether surprising to find reports of cases of other diseases, now thought to be due to infection, following close after an attack of appendicitis.

Dr. L. H. Hempelman, in a paper before the St. Louis Medical Society, reported in the *Journal of the Missouri State Medical Association* in June, 1919, is quoted as saying that he has seen a chronically inflamed appendix associated with duodenal ulcer so often that he is convinced of their close association, and has always advocated the routine removal of the appendix when operating for duodenal ulcer. It is his observation that all sorts of stomach symptoms will frequently clear up, even when the stomach is found normal, after the appendix has been removed.

Dr. Richard Lewisohn of New York, in the *Medical Record* for June 17, 1916, reports four cases of duodenal ulcer that had been previously operated on for chronic appendicitis. In these cases a duodenal ulcer developed six years, two years, one year and four months, respectively, after the appendectomy.

Attention should be called to numerous reports of cases

showing cholecystitis, phlebitis, and other infections following in the wake of appendicitis.

In this connection we may perhaps call to mind Moynihan's dictum that most of the ulcers of the stomach are situated in the right iliac fossa.

These brief references are perhaps sufficient to show the general trend of conclusion of investigators during the last few years as relates to the bacterial cause and relationship of appendicitis to other diseases.

When we turn our attention to a study of clinical results of appendicitis as contained in post-operative studies of cases and in hospital reports, it is difficult indeed to find any great amount of information that is directly helpful to us, but there are some things that may be pointed out, from which we may hope to draw reasonable deductions. A brief reference to some of these reports will give us fragmentary bits of information that we may well keep in mind.

Dr. John B. Deaver, in the Pennsylvania Medical Journal for March, 1919, reports some of the post-operative sequelæ of acute appendicitis in a series of 1,700 operations from the recent records at the Lankenau Hospital at Philadelphia.

It is to be remembered that this report gives the operative or early post-operative mortality and is, therefore, only indirectly of interest to us. This series included all cases of acute appendicitis with and without pre-operative complications, directly due to the condition of the appendix or some other organs.

In this series there were sixty-six deaths, giving a mortality of 3.8%. Mention may be made of the more frequent post-operative sequelæ in this series requiring one or more subsequent operations, and these were fecal fistulæ, secondary abscess, and intestinal obstruction.

Dr. H. J. Donaldson of Williamsport, Pennsylvania, reports from the Williamsport Hospital Records for a period of five years ending June, 1918, a series of 622 operations for appendicitis, with sixteen deaths, or a mortality of 2.5%.

In the *Annals of Surgery*, Volume VI, 1914, Dr. William B.

Brinsmade, of Brooklyn, reports a series of 110 consecutive cases of appendicitis operated upon without mortality. In this article Dr. Brinsmade calls attention to the observation that appendicitis is most common at those times when epidemic influenza is rampant, and also when summer diarrhœas prevail.

The post-operative sequelæ in 1,748 cases of appendicitis operated upon at the Roosevelt Hospital from 1910 to 1915 were reported by Alfred Stillman, in the Medical-Surgical Reports of the Roosevelt Hospital for 1915. Out of the 1,748 cases there were 124, or 7%, that had important sequelæ, some of which required further surgical treatment. The mortality for the cases with sequelæ was 23.3%, but for the series as a whole it was only 2.8%.

Dr. Clarence A. McWilliams, in the Medical and Surgical Reports of the Presbyterian Hospital in 1904, gave a report of 86 cases of intestinal obstruction following appendicitis, with a mortality of 33.7%. Nine of these cases had a history of appendicitis *without* operation, and this bears out the statement by William J. Mayo, in Collected Papers of the Mayo Clinic, 1914, "That in appendicitis cases with abscess and drainage, there is a small but definite liability to intestinal obstruction from adhesions, bands, etc., and hernia, but that these individuals are in no greater danger from such complications than is the individual who has not had his appendix removed of having trouble with it of any equally severe grade."

Most of the cases of intestinal obstruction referred to by Dr. McWilliams occurred during the first two years after appendicitis.

In the *American Journal of Medical Sciences* for May, 1920, Dr. Charles L. Gibson, of New York, reports the results of operation for chronic appendicitis in 555 cases. After deducting 126 cases in which no subsequent record was obtained there remained for study 429 cases. These were divided into four groups, dependent upon end results, as follows: Excellent, 259 cases; satisfactory, 65 cases; unsatisfactory, 102 cases; deaths,

3 cases. Only three deaths in the 429 cases that they were able to trace gives a remarkably low mortality of .7 of one-per cent.

His group of 102 unsatisfactory cases became the object of further detailed study and analysis. After expending all reasonable effort to have these cases subject themselves to more examinations, particularly those bearing on the symptoms complained of; for example, gastric analysis and Rœntgen ray for gastro-intestinal conditions, they were able to persuade 26 cases or 25% of the group of 102, to reënter the hospital for observation and careful examination. While the results of these examinations are given in some detail, it is perhaps sufficient to note here that there were four cases of gastroptosis, three of which had had shown a definitely pathological appendix previously; four cases of presumptive post-operative adhesions; two cases of ulcer of the stomach; one case of cholelithiasis; one case of abscess of colon; one case of sacro-iliac arthritis and one case of cystoma of ovary.

The chief complaint after operation was shown to be pain in some form, either vague pains, or pain in the appendix region, or pain "same as before operation" or pain in epigastrium. It is perhaps well to note that in this group of 102 cases, classed as unsatisfactory from the standpoint of results, the appendix has been found to be definitely pathological in 63%.

In attempting to explain these unsatisfactory results, Dr. Gibson says, "It seems fair to say that in a certain number there were, in addition to appendicitis, other conditions overlooked at the time of operation," and he calls attention to the fact that the frequent co-existence of disease of the upper abdomen with chronic appendicitis is to-day well established.

In this connection I should like to refer to a study of post-operative end results in chronic appendicitis reported by Dr. Stanton, of Schenectady, New York, in the *New York Medical Journal* of September 6, 1919. There were 110 cases of pre-operative diagnosis of chronic appendicitis and definitely cured as proved by the end result record, extending over periods of from one to ten years, following their operation.

Dr. Stanton further says that previous to 1911 when he first

reviewed his end results in these cases he had errors in diagnosis amounting to 36%. During the past eight years 86% of the patients he has operated upon for chronic appendicitis have been definitely cured by the operation. The uncured patients, amounting to 14% of the group have, for the most part, fallen into two rather sharply defined groups, the larger of which is composed mostly of young women who complain of right inguinal pain, usually associated with varying degrees of constipation, and most of whom at operation had a normal appendix. The second group referred to by Dr. Stanton includes those who had been operated upon under the belief that the appendix might be the cause of various obscure gastro-intestinal symptoms.

In the medical and surgical papers of the Massachusetts General Hospital for January, 1913, there is a report by Dr. Charles L. Scudder and Dr. Harry W. Goodall that shows one of the most complete and painstaking and valuable studies of the end results of appendicitis that I have been able to find in the literature. I shall take the liberty of quoting quite freely from this paper, for their tabulations seem to point out some interesting facts.

These end result studies were based upon the returns received from 640 cases out of a series of more than 3,000 appendectomies.

As regards distribution by sex of the 640 cases, 28.8% were female and 71.2% were male.

As regards age distribution, the greatest number, 230 cases, or approximately 36% occurred between ages 20 and 30.

As regards frequency of previous attack in the 640 cases, there were 226 cases or 35.3% with no previous attack.

The results in this series of 640 cases were learned at periods after the operation varying from six months to twenty-two years. The number of cases which reported from one to five years after operation was 61; the number reported from five to fifteen years after operation was 560.

Condition reported as good, very good, excellent, well, perfectly well, O. K., 606 cases or 94.6%.

Condition reported as poor after operation, 26 cases or 4.6%. In this series of 26 cases reporting poor health after operation there were mentioned:

No cause	7 cases
Indigestion	6 cases
Trouble from hernia in scar	2 cases
Peritonitis following operation	2 cases
Diabetes following operation	2 cases
Phlebitis following operation	1 case
Gall-stones diagnosed	1 case
A panhysterectomy was done at the time of operation in	1 case
Patient died of cancer within a year in	1 case
Post-operative neurasthenia in	1 case
Sacro-iliac disease in	1 case

There were 38 cases reporting so-called subsequent attacks, which could be interpreted, with the appendix removed, to mean that there was pain or other symptoms resembling the symptoms previous to operation. In most instances these symptoms seemed to have been experienced in the first few years after operation, and did not preclude a reasonably good state of health subsequently, which fact is indicated by the report of the final results, showing that 94.6% in 640 cases were reported to be in good health and were relieved by the operation.

In regard to the likelihood of recurrence of appendicitis: in the cases studied by Scudder, 414, or 64.7% of the cases had two or more attacks.

Hussey, of Providence, in the *Rhode Island Medical Journal* for May, 1918, reports 78 cases with a history of one or more previous attacks in 57 cases or 73%.

McWilliams in the *Annals of Surgery*, 1910, reporting upon the analysis of 1,411 operations upon the appendix at the Presbyterian Hospital records 647 cases of acute appendicitis, 34% of which had had one or more previous attacks.

According to Lett, Surgeon to the London Hospital (*Lancet*, January 31, 1914), "Appendicitis is essentially a disease where relapse is the rule and where freedom from recurrence is the exception." To quote him further, "Of 233 cases collected by

Karrenstein, 50.2% have further attacks, 60% in the first year, 20% in the second, and 20% subsequently. In 1,933 cases Kummell found that 51.1% had had previous attacks."

That the results following the opening of the appendix abscess, without removal of the appendix are not very satisfactory on account of recurrence of further inflammatory disease of the appendix is shown by the following brief references. The late Dr. Oliver C. Smith, of Hartford, *Medical Record* of October 8, 1910, in an article on the Residual Appendix, reported his own experience in a series of 1,000 operations for appendicitis, with an extensive review of the literature at that time. The results may be briefly stated as follows: In appendicial abscess cases operated upon without removal of the appendix, there were subsequent inflammatory conditions, either acute or chronic, in 17½% of the cases reported by Dr. Smith, in 24% of the cases reported by Sir Frederick Treves; in about 40% of the cases reported by Clogg, of London.

McWilliams, in the *Annals of Surgery*, 1910, without referring to the frequency with which subsequent trouble appeared in abscess cases operated upon without removal of the appendix, reports a mortality experience with such cases of 23%.

At the Annual Meeting of the Medical Society of the State of New York in March of this year Dr. McWilliams read a paper in which were recorded the end results in 200 operations for chronic appendicitis on ward patients in the Presbyterian Hospital during the years 1916 and 1917. These cases were kept under observation by a very strict follow-up system, and it was learned that cures were effected in 151 or 75%; 22 or 11% were improved, and in 13% there were failures. Dr. McWilliams calls attention to an observation made in a series of 58 cases in private practice, not operated upon by any one man, in which the results were by no means as satisfactory as in the ward cases, which was interpreted to mean that the ward cases were more carefully studied before operation for the purpose of detecting associated or concomitant conditions that might be causing the symptoms.

The discussion of this paper showed that others were of the belief that appendicitis was often diagnosed when other conditions were responsible for the symptoms.

This review, incomplete as it is, of surgical reports, of end results in appendicitis cases, is perhaps enough to show, first of all, that the operative and early post-operative mortality is quite low, probably less than 3% as a rule. Secondly, that a fairly large number of cases, from 13% to 24%, may show unsatisfactory results following operation, and a certain number of these appear to develop trouble in some other organ of the body. In these cases, having become thus separated from the appendicitis group, it is altogether likely that some extra mortality will be experienced, dependent upon the location of the trouble and if due to infection, dependent upon the virulence of the micro-organisms present. Therefore, it is clear that the importance of this disease is not to be measured in terms of the post-operative mortality.

Our attention has been called to the close relationship of appendicitis to other diseases, not only within the abdomen, but in more remote parts of the body.

If a particular strain of streptococci responsible for an inflammation in the appendix may, upon assuming a different degree of virulence, cause a cholecystitis or a duodenal ulcer, or an arthritis, or even an endocarditis—conditions not to be dealt with lightly from an insurance standpoint—it becomes evident that a true valuation of a case with a history of appendicitis, must take into account the likelihood of development of complications or sequelæ such as those named.

A logical inquiry is, how often or in what percentage of cases with a history of appendicitis, may conditions of such importance be expected to arise? Our approach to the answer to this question unfortunately must be by the indirect route, owing to the absence of statistical information that can serve as a valuable guide.

Reference to the surgical reports, some of which I have quoted, gives the impression that such important complications are relatively infrequent, although numerous isolated cases are reported.

Reverting to the bacteriology of appendicitis, it appears that the infective organisms, usually streptococci, are of relatively low virulence, and only under favorable conditions do they show a tendency to undergo transmutation into strains of higher virulence, when they may attack other tissues and organs.

It would seem that whatever answer is to be given to the practical question before us, our opinions must be based largely upon such considerations as those here mentioned, and it appears quite within reason to believe that a history of appendicitis has an influence in producing a mortality above normal during the first year, and probably to a less extent during the second year following an attack.

That this influence may last for much longer periods in some instances is undoubtedly true, as shown by the reports of cases in current literature, but in general, the practice now followed by some companies of discounting a history of appendicitis (single attack) more than two years prior to the date of application for insurance would seem to be justified.

A history of repeated attacks of appendicitis presents a problem of more gravity, not only on account of the greater difficulties to be encountered at operation, but also there is the probability in a considerable number of instances of associated disturbance elsewhere than in the appendix, and some of these associated conditions may be of greater importance from our standpoint than appendicitis itself.

That such cases should be put upon a longer period of probation than those with a history of a single attack, appears altogether rational in view of the incomplete diagnosis in some.

In our consideration of cases that have been operated upon for appendicitis in the acute stage, it is apparent that inquiry should be made to learn whether or not the appendix has been removed, for the assumption seems unwarranted that an appendix, with drainage of the abscess, will give rise to no further trouble.

No one realizes more than I the shortcomings of a paper such as this one for consideration by this Association, but the

fragmentary bits of information that I have been able to gather from current writings and to assemble in this form, while not pointing out any strikingly new truths, may be of some service in furnishing reasons to justify our present practices. My earnest hope is that the discussion to follow will make up for some of its deficiencies.

Dr. Gage—Mr. President and Gentlemen: This subject of appendicitis was first brought before the attention of the Association in 1896 in a paper by Dr. Albert Wood, and in that paper he gave an interesting classification of the results of personal communications from various surgeons, stating their views as to the results of appendicitis.

The conclusion drawn was that two years after an operation the risk was insurable at standard rates, if the applicant passed a satisfactory examination at that time; and that the cases which showed a history of continuous attacks of appendicitis were not insurable until after the elapse of about five years.

Then, we began to look upon appendicitis with a little more leniency, a view that was confirmed by the results of the Medico-Actuarial Investigation which included only those cases showing a history of appendicitis which had not been operated upon, and which showed a very favorable mortality.

Now Dr. Rowley takes us back by reviewing the cases that have been reported from the different clinics showing the ultimate results, or at least investigations covering several years after the operation; and this shows a considerable number of failures to relieve symptoms, and a considerable number of cases in which other complications have occurred that affect the insurability of the risk.

In the first place, it seems to me we ought to recognize the fact that we have not what we ought to have, and that is, any definite statistical information with regard to the effect of the operation on longevity. It does not seem unreasonable to believe that those statistics could be had by investigation in some of our large clinics. Absolutely the only real statistical information we have is from the Medico-Actuarial Investiga-

tion, and that includes only the non-operated cases and shows a favorable mortality.

In the second place, I think we have to be very careful about accepting theories as to the causation of appendicitis. The Rosenow theory is a very attractive one, and it has a good deal to commend it, and a good deal of corroborative evidence has been given in its support; but it has not been absolutely confirmed in any other laboratory, and the Rosenow theory is looked upon as still under discussion and not settled.

As a matter of fact, speaking of streptococcus as the usual cause, it may be true in many cases, but it is not in accordance with my own experience or my judgment, which is, that the prevailing cause, as found from cultures taken at operation, is usually the colon bacillus, though it is possible that the streptococci may have disappeared.

But we still have the question of the effect of infection on the insurability of a risk. I do not know of any statistics we have that are absolutely reliable in regard to that. I think Dr. Dwight made some investigations of the result of severe infections such as erysipelas and things of that kind, in his own Company's experience, which showed that it had a rather definite effect on the insurability of a risk, but there are no other statistics.

In the third place, I think we must be very careful not to accept everything that is labeled appendicitis. There is no question that the development of a safe operative technique has helped greatly to increase the number of cases of appendicitis, and made many unnecessary operations. More than that, it has lead to operations in cases where a definite diagnosis of appendicitis was not made, but where the chance was taken that that might be the cause of the symptoms, and the removal of the appendix was consequently undertaken.

The result of that is, that many of these cases to which Dr. Rowley refers, which have developed complications after the operation, really had a condition existing prior to the operation independent of the appendix itself, and that applies, I think, to a large proportion of the cases of so-called chronic appendicitis.

He takes up in his paper the development of duodenal or gastric ulcer following appendicitis. My own theory is that the gastric or duodenal ulcer was probably there before, and the removal of the appendix did not affect it in any way whatever. But I do not believe that has a very marked bearing upon our problem, because those are the cases in which the symptoms still continue, and if we get an honest statement from our applicant and a careful examination from our examiner, it would bring out the fact that there was still some impairment remaining.

On the whole, it seems to me that we should go on hunting for further accurate statistics in regard to appendicitis; in the meanwhile accepting the general consensus of surgical opinion that acute appendicitis is generally recurrent, and usually requires operation sooner or later, and that therefore, an attack of acute appendicitis is an impairment whose importance is proportionate to the length of time which elapses since it occurred. With relation to the application for insurance, its importance diminishes as time elapses.

After operation for acute cases, I believe a moderate time should elapse, and I do not think six months either too short or too long, to show the complications which would ordinarily develop following operation, provided the condition was appendicitis, the operation was successful, and the patient passed a good examination. Cases of chronic appendicitis with or without operation I do not think we can accept as standard cases.

Dr. Toulmin—I think that I have stated to the Association on other occasions that in our Dr. Hutchinson, Assistant Medical Director, we have a surgeon who in Philadelphia we consider second to none, a man of very wide experience, unusually good common sense, and who has had twenty years of experience in selecting lives for the Company. He draws a distinction in the operative cases between those in which the wound was immediately closed, and those in which the wound is left open, drainage cases, and feels satisfied that it is safe to take the former two months after the operation, and postpones the

latter for a year after operation, his observation having satisfied him that the danger of adhesions is far less in the former than in the latter.

Dr. Weisse—Dr. Toulmin's custom coincides very closely with ours. We will take a man where an appendix has been removed, primary union, no drainage, within six months after recovery, but if there has been drainage, we hold him up for a year.

Dr. Gage—I think it is playing safe, and I should draw a distinction between the two. I should hold a man out longer who had had a drainage and a long suppurating wound. That man has suffered infection. It is not only a question of drainage and a question of adhesions, but also a question of the effect of the severity of his infection, the amount of constitutional effect of the acute inflammatory process. But in my own experience I should say that most cases, even of drainage, will develop any trouble inside of the year.

Dr. Dwight—I can answer one question which Dr. Gage has proposed, and furnish him with a few statistics of very moderate value on account of their small number. He says there are no statistics on operative appendicitis. My predecessor, as you know, was a surgeon of great ability and experience and when I first came to the Company in an executive capacity I was rather startled by the freedom with which he took cases of appendicitis after operation, just as soon as they were healed he was sure they were all right, and on account of my skepticism this was among the first classes we investigated. It was a comparatively small class, only a few hundred of them, but with an average mortality of 74% for our total business, our experience with operated cases of appendicitis was less, and I believe that it was less than 50%. I know it left clearly on my mind the impression which I have gradually strengthened, that Dr. Homans was apt to be right on these subjects.

We are now taking these cases very freely after operation. We agree with Dr. Hutchinson as to the probability of adhesions, and we delay the acceptance longer in those cases,

but we take clean cases very soon after operation and we take the others within six months, if there have been no symptoms.

Dr. Weisse—Does not that depend upon the duration of the healing process?

Dr. Dwight—Yes, on the duration of the healing process, and the duration of symptoms. On the question of mortality following infection by certain bacteria, streptococcus, and staphylococcus, we have a series of groups in which the applicant mentions in his personal history conditions which were in all probability due to staphylococcus or streptococcus infection. These groups all show a high mortality in late life. This is a considerable number of small groups and to my mind give us more important information than one large heterogeneous group. We are satisfied at our office that the history of conditions due to staphylococcus or streptococcus infection, while not sufficient to cause a rating up or declination of the case, should be seriously considered in connection with any other impairment which is apt to cause an increased mortality in late life.

DISCUSSION

Dr. Beckett—Mr. President and Gentlemen: I left home before the galley proofs were sent out, and so I did not have an opportunity to read this paper until after I came to the city, and what I have to say will be largely from my own experience as I have not had time to look over the recent literature.

It is a fact that we are still paying death losses from appendicitis. There are certain stomach symptoms associated with appendicial inflammation. Almost any abdominal inflammatory condition may be ushered in by pain in the stomach, more or less severe, according to the severity of the infection, and it is frequently very difficult to say in the beginning whether the trouble is appendicitis, cholelithiasis, ulcer of the stomach, or duodenum. The symptoms usually become more definite within a very few hours and the pain will radiate to the appendicial region with a marked tenderness at that point, if the

appendix be involved. I believe, in a majority of cases, where you find two or three of these diseases associated, that it is usually due to the same infection. A great many cases are treated for chronic stomach trouble or chronic gall bladder trouble that are in fact chronic appendicitis. Frequently cases with indefinite stomach symptoms, where the pain is confined largely to the region of the stomach, are treated for some stomach or gall bladder affection, when on close examination you will find a tenderness in the appendicial region. These cases are usually entirely relieved by the removal of the appendix. It is not always easy to find out the cause of infection of the appendix. Almost any infection along the intestinal tract may produce an infection of the appendix. I have operated during typhoid fever for acute appendicitis due to a typhoid infection. Chronic appendicitis as an active focus of infection should be considered. I believe there are many cases of heart lesion, or kidney lesion, resulting from chronic appendicitis.

I would like to speak particularly about one class of cases, and these are the drainage of appendicial abscesses without removal of the appendix. Most frequently the appendix will become obliterated, and will give no further trouble, but I have seen one case in particular where the abscess was drained three different times and then subsequently the appendix was removed, and these abscesses were drained nearly a year apart. Each time the surgeon supposed he had cured the appendicitis. I believe these cases should be postponed for at least one to two years.

A crippled appendix is sure to give trouble some time in the future. There is a vast difference as to the risk between a drainage case and an acute case. If you get a case before much damage has been done, with no history of previous attacks, where the recovery is prompt and the union is primary, you can take such a case almost any time after they are thoroughly well from the operation. I believe it is good practice to postpone any abdominal case for at least six months after the operation. The drainage cases, where there has been con-

siderable infection, or where there have been repeated attacks with adhesions, are always more hazardous than the acute cases. In operating later upon those cases that have had the appendix removed during an acute attack, you will frequently find no adhesions whatever, while in those chronic cases, where there have been adhesions prior to the operation, or those cases where there has been a great deal of inflammatory trouble at the time of the operation, you will find a great many adhesions following the operation. Those adhesions may cause strangulation of the bowel or other viscera. These troubles usually come on within the first year following the operation, but I have seen a number of cases go for four or five years after the operation before the strangulation took place. The mortality in cases of strangulation of the viscera is very high. If a surgeon has a mortality of 20% he thinks he is fortunate, and I believe he is. I think there is a hazard in these cases that does not pertain to the acute cases, and it has been my practice to postpone drainage cases at least one year. I try to get a statement from the operating surgeon as to the pathology existing at the time of the operation, and this assists me, and I am sure it does others, in estimating the hazard.

Post-operative hernia has a mortaliy so low that I think it does not need very much consideration—not much more than any other hernia.

This is a very excellent paper that the Doctor has given us, and it is well to consider these cases, but I believe we should consider them largely upon their own merits. The mortality is not very high in appendicitis following operation, but those that have had appendicitis without operation I should postpone for two or more years after an attack before accepting the risk. As I have stated, a crippled appendix is very sure to give trouble later on, and all such cases should be postponed until after the appendix has been removed.

Dr. Snow—I take it that our attitude towards an applicant with a history of one or more attacks of appendicitis is largely dependent upon the prognosis of further attacks. To confirm an impression which I had gained, I have taken two hundred

claims in series, cause of death given as appendicitis, and forty consecutive claims occurring during the period represented by the first group; 33 deaths from intestinal obstruction (non-malignant), and 7 from peritonitis (non-tubercular), with the surprising result that in the 200 appendicitis cases, only one gave at examination a history of gastro-intestinal disturbance of any kind whatsoever, and *that* a vague history of dyspepsia some years before.

Of the 7 peritonitis claims, only one gave a history of gastro-intestinal disturbance—that simply biliousness, the duration of this was eighteen years.

Of the 33 intestinal obstruction cases, one gave a history of stomach trouble many years before, and on one there was recorded an impairment of the digestive organs one year previously.

Not one of the other 237 had a recorded M. I. B. impairment, either previous to acceptance, or subsequently entered. I simply want to report the results of investigation of one phase of this subject made available by our records. The non-committal results shown in Class 39 in the M.-A. Mortality Investigation led me to believe that our own experience would be valueless, and therefore I approached the subject from another direction.

240 DEATH CLAIMS (1920–1921)

APPENDICITIS (200 CLAIMS)

Without Previous History

Duration	Number
1– 5	69
6–10	57
11–20	52
Over 20	21
Total	199

With Previous History

Duration	Number	History
15	1	Dyspepsia
Total	1	

PERITONITIS (7 CLAIMS)

Without Previous History

Duration	Number
1– 5	2
6–10	2
11–20	2
Over 20	0
Total	6

With Previous History

Duration	Number	History
18	1	Biliousness
Total	1	

INTESTINAL OBSTRUCTION (33 CLAIMS)

Without Previous History

Duration	Number
1– 5	4
6–10	10
11–20	9
Over 20	8
Total	31

With Previous History

Duration	Number	History
3	1	(Stomach trouble and Dyspepsia (tape-worm)
17	1	500a '06*
Total	2	

Age		Duration	
Youngest	17	Shortest	2 mo. 14 days
Oldest	81	Longest	57 yrs. 11 mo.

A series of 100 claims, cause of death being gastric and duodenal ulcer, show an entirely different picture. In 85 of these cases, there was no gastro-intestinal history nor any recorded M. I. B. impairment, either previous to acceptance or subse-

* M. I. B. Impairments.

quently entered. Of the 15, 2 gave a history of an appendectomy, 5 indigestion or dyspepsia, 2 liver trouble or occasional bilious attacks, and 6 cases were subsequently impaired; 3 for 510 (ulcer of stomach), 1 for biliary colic, 1 for appendicitis without removal, and 1 for dyspepsia and gastric catarrh.

100 DEATH CLAIMS (1920–1914)

DUODENAL AND GASTRIC ULCER

Without Previous History

Duration	Number
1– 5	18
6–10	16
11–20	30
Over 20	21
Total	85

With Previous History

Duration	Number	History
1– 5	1	Appendectomy 1913
6–10	5	Appendectomy 1905 Ulcer of stomach* Liver trouble Indigestion (2)
11–20	4	Indigestion (2) Dyspepsia Dyspepsia and Gastric Catarrh*
Over 20	5	Appendicitis without removal* Ulcer of stomach (2)* Biliary Colic* Occasional Bilious Attacks
Total	15	

One hundred consecutive claims, cause of death cholecystitis and cholelithiasis, gave the following results. In 80 of these cases, there was no prior history of gastro-intestinal disturbance, nor any M. I. B. impairment, either antedating issuance or subsequently received. Analysis of the other 20 cases shows that 5 had a history of renal colic; 2 gave a history of gall stones in the remote past; 2 had a history of indigestion; 1 slight

* M. I. B. Impairments.

kidney trouble some years before; 1 liver trouble 2 years before; 1 a history of appendectomy; 1 peritonitis 15 years previous; 1 occasional bilious headaches, and 6 cases were subsequently impaired—3 for 502 (biliary colic) and 3 for appendicitis without removal (possibility of error on wrong diagnosis).

100 DEATH CLAIMS (1920–1913)

CHOLECYSTITIS AND CHOLELITHIASIS

Without Previous History

Duration	Number
1– 5	16
6–10	19
11–20	30
Over 20	15
Total	80

With Previous History

Duration	Number	History
1– 5	2	Possible Renal Colic 4 yrs. before Gall Stones 12 yrs. before
6–10	4	Appendicitis without removal (2)* Operation for gall stones Liver trouble (last attack 2 yrs. before)
11–20	8	Renal Calculi 1895 Indigestion (2) Slight kidney trouble (4 yrs. before) Renal Colic Biliary Colic* Appendectomy Appendicitis without removal*
Over 20	6	Biliary Colic (2)* Occasional Bilious Headaches Renal Colic Renal Calculus passed 5 yrs. before. Peritonitis 15 yrs. before
Total	20	

* M. I. B. impairments.

In two groups, Duodenal and Gastric Ulcer, and Cholecystitis and Cholelithiasis:

Age		Duration	
Youngest	24	Shortest	1 mo., 16 days
Oldest	86	Longest	54 years.

To return to the appendix cases; that is, those which became claims on this account, our experience would have no value if our selection on appendix cases had been particularly close. As a matter of fact, it has not. I think we have always accepted cases where there was a history of a single attack two years or more previous to examination and, in recent years, one year has been our requirement.

As to a history of more than one attack, there has been more or less change but, in a general way, our selection on these cases has never been especially close. Hence there are on our books many cases with appendicitis histories and it is of interest to know that not one of these has become a death claim from that cause within the last six years.

Our action on recent cases, single attack, is based more, perhaps, on the general picture than on the special one. Where there is a recent history, we endeavor to determine, through the examiner, the applicant's attitude toward operation; that is, whether or not operation was advised at the time of his attack; whether or not it was refused; and the probable attitude toward operation, if advised by the attending physician, in case of a subsequent attack. Our examiners usually cover this point at the first interview, though in many instances this information has to be obtained subsequently. Then, too, our attitude is based upon the accessibility of good surgery. This, of course, is more or less of a guess but it has bearing.

Those of you who recall the observations and deductions, or who reviewed the paper presented to the Association by Dr. Albert Wood in 1896, will be surprised to note how closely it conforms to the opinion and practice of to-day.

Dr. Rowley—Mr. President and Gentlemen: There is very little to say in closing the discussion of this paper.

The type of cases that we most need to consider, I think, are the cases without history of operation. They are the most important. Dr. Gage and others have well spoken of those. In the cases that have one or more attacks of intra-abdominal trouble that is called appendicitis, so often the trouble is somewhere else than in the appendix, and I think the importance of those cases from our standpoint lies in that fact—that there is often some other pathology more important than disease of the appendix itself.

Dr. Gage has put the brakes on a little bit with regard to accepting the theory of infections as the cause of appendicitis. It is a very nice theory, and I wish we might embrace it with open arms, for it makes some things more clear than otherwise would be. I do not think we can change the practises followed by the Companies of postponing these cases. I think the practises established years ago and adhered to in general by all the Companies are safe and sane, and while we all have had the feeling and the knowledge from observation that cases with a history of appendicitis are apt to give an unfavorable experience away and above the operative mortality itself, the reasons for that have not been at all clear, and if we could embrace the infection theory and assume that the infection has localized itself somewhere else and is likely to crop out in some other disease, that would explain away some of the clouds of doubt that we have had.

The paper has accomplished one thing that I hoped it would accomplish, and that is, that it brought out discussions more valuable than my original contribution, and I am particularly indebted to those who have added to it.

Dr. Weisse—I think we should thank Dr. Rowley. He was extremely timorous about taking the paper during the winter, when I was communicating with him, but I think he has given us a paper that is a very scholarly one, and of distinct advantage to the Association. I was very much interested in his

striking the same question of focal infection with reference to the appendix without any previous collaboration with Dr. Bradshaw.

Before taking up the two papers on laboratory work and urinalysis, Dr. Exton will present an invention of his.

Dr. Exton—The apparatus for obtaining the specific gravity of minute quantities of urine, even a small drop, is called an "Immiscibles Balance." The principle of immiscibles is not new but its application has hitherto not been practical. If one takes a light liquid like oil which does not mix with water, and a similar heavy liquid like chloroform, their proportions in a mixture may be handily changed so as to control at will the specific gravity of the mixture. In such mixtures a drop of urine is distinctly visible having the appearance of the bubble in a carpenter's level.

Our balance consists of an ordinary cylinder or jar, such as is used with urinometers and this also serves as a mixing chamber. The lighter liquid is conveniently brought through the bottom of it under pressure and the heavy liquid is dropped in from the top. If a drop of urine be introduced into such a mixture it will fall to the bottom if it is heavier than the mixture, or it will rise towards the surface if it is lighter than the mixture. When it establishes itself in equilibrium at the middle of the mixture its specific gravity must be identical with that of the mixture, and this is then ascertained with a hydrometer in the usual way. The estimation can be made in a minute or two and is perfectly accurate. The liquids may be used over and over again by pipetting out the drops of urine or by filtering through chamois, and the stopcock which serves as the floor of the mixing chamber is so devised as to permit the separate discharge of the contents of the funnel and mixing chamber, as well as to bring the contents of the funnel into the mixing chamber.

We have found that a mixture of spirits of petroleum (sp. gr. 0.77) and carbon tetrachloride (sp. gr. 1.600) is quick and

accurate for urine work. The specific gravity of a drop of almost any fluid, and of many solids, may be handily had with the apparatus, and we are at present experimenting with a view to quantitating albumin, etc., by the difference in density of specimens before and after extraction of the albumin with the promise of developing a very rapid method. The hydrometers we use with the Immiscibles Balance are specially designed for quick and accurate work.

By making the greatest circumference of the bobbin a mere hair line and by a balanced pivot, remarkable freedom from tendency to hang to the jar is attained as well as a minimum of bobbing up and down so that they settle very quickly. The scale is blocked instead of lined, which improves visibility as well as accuracy, even permitting readings of one-half points in the fourth decimal place.

The method involves some fine points of physics which I have not yet been able to fathom, although we have been working with it for three years, but the Immiscibles Balance gives quick results of established accuracy.

Dr. Weisse—Dr. Exton's paper is of great interest from the laboratory standpoint, and I hope that most of the members have seen his apparatus which has been on exhibition during the last two days.

Euscopy

Dr. Exton—In 1916 the strain and fatigue associated with the constant use of such optical instruments as the microscope were vividly brought to my attention and observations were instituted with the hope of ascertaining the chief cause or causes of the troubles which our microscopists were experiencing. A number of influences were found to be operative and these were not only those associated with ocular physiology, but also some which have to do with the posture of the body and head, and experiments were undertaken for the purpose of relieving them if it were possible.

All of these features will be discussed more extensively in another communication, but the experimental demonstration you have seen will convey the grateful sensation of relief and freedom from strain which is afforded by natural binocular single vision by protected reflected light yielding enlarged images and the comfort resulting from a natural position of the body and head. For this the term euscopy is proposed, and as you see, the euscope consists of a conveniently mounted funnel-shaped viewing chamber on the floor of which, near the smaller or ocular end, is placed an aperture for receiving the eye-piece of the microscope or other optical instrument. By means of a total reflecting prism or a mirror mounted above this aperture the rays of light which are concentrated into a sharp pencil by the optical construction of the microscope are bent at a right angle and reflected on a screen, thereby avoiding the direct impact of pointed light on the delicate nervous structure of the retina.

In addition to its strain-saving features the construction of the euscope permits other convenient advantages. For teaching or demonstrating either in a light or dark room several different arrangements are available. Photographing on plates or making direct prints on bromide paper may be very handily and quickly done. By the use of stereoscopic or magnifying lenses or telescopic magnifiers higher magnifications than those which are possible with the unaided microscope may be had and the images seen in three dimensions if such is desired. Color screens or lenses may also be used in conjunction with the reflecting medium, and the method will be found especially grateful by those who wear eye-glasses.

All of the advantages and conveniences which have been enumerated may be had with any make of microscope and with one's accustomed manipulative technique, the euscope occasioning no other change than the use of an appropriate source of illumination.

A finished and simplified model of the euscope is now in preparation by the Bausch and Lomb Optical Company of Rochester, N. Y.

SOME INCIDENTALS OF URINALYSIS

By William G. Exton, M.D.

Assistant Medical Director in charge of the Laboratory of the Prudential Insurance Company, Newark, N. J.

Although technical preferences and some differences of practise exist among us, the guiding principles of the routine urinalysis are now uniformly recognized, and, in conjunction with other available information, serve to distinguish acceptable risks from those which are not acceptable. Between these two classes fall the doubtful and the border-line cases, which properly to rate and dispose of put the medical director on his scientific mettle.

Of these, some are obscured by incidentals of personal or insurance history, and some by the other features of the medical report, but many are colored with doubt by a chance specimen of urine, which may happen to reflect a transitory, accidental or insignificant condition.

Some of the albumins and sugars and many of the abnormally high and abnormally low gravities which are encountered exemplify this, and when any of these are associated with other doubtful features the cases are apt to take on an unfavorable aspect, although many of them are perfectly good risks and would be promptly appreciated as such if we had at our disposal all of the advantages which are available to the practitioner.

Our work must be done by simple and rapid methods, with minimum amounts of urine, with the utmost economy of time and correspondence and with the least possible inconvenience to examiner and to applicant. With these limitations, tests of the authentic urine, or data easily had from examiners, are extremely valuable, if of decisive character.

Therefore it happens that in order to clarify obscurities and resolve doubts the occasional employment of certain tests and criteria which do not afford the clinician the specific differential diagnostic information he wants may nevertheless fully answer

our requirements. Thus, reactions like the diazo and others when positive denote the presence of definite disease, and some of the chromogens, like urorosein and nephrorosein, are never present in normal urine, but do occur in the urines of persons with tuberculosis, nephritis, and digestive diseases.

On the other hand, the practitioner, as a matter of course, makes use of some tests which are of the greatest practical value and which would greatly assist us too, if it were only possible for us to employ them.

Of these, perhaps, the classical example is the twenty-four-hour specimen, which not only tells the story of the metabolism of the individual, but also gives evidence of disease in other organs as well as those of the urinary system. Although we cannot have a twenty-four-hour specimen, we can, and usually do, get, before acting on the case, a specimen indicative of the power of the applicant's kidneys satisfactorily to concentrate urine. Such a specimen is of normal gravity, and the gravity of normal urine being, for practical purposes, made up of its salt, and its urea content, the presence of both of these substances in normal proportions is an indicator of physiological metabolism in so far as the constituents of normal urine are concerned.

There is no question but that the nitrogen partition and other determinations of a twenty-four-hour specimen afford a better index, when the exact ingestion is known, but what may be called the specific-gravity-salt-urea ratio will be found a satisfactory substitute for life-insurance purposes.

Physiological urine averages 40 p.m. solids, the salt amounting to about 10 and the urea to about 20 p.m. The specific gravity of salt is 2.15, and of urea 1.32. On an ordinary diet almost 90% of the total nitrogen is excreted in terms of urea, and on any but a salt-free diet there is a surplus of salt for the purpose of the ratio. Therefore, all urines having specific gravity of 1015 or higher should show a compact white ball when a drop or two of silver nitrate are added to the overlying urine of the Heller's test or to urine strongly acidulated with nitric acid. Any tendency to spreading or clouding denotes

an abnormally low chloride excretion. Even urines of 1010 specific gravity should show something of a rotundity, or at most only a very slight spreading of the silver if the chloride excretion be normal. Lowered salt excretion is evidence of chloride retention or salt-free diet.

By the simple hypobromite method urine of 1020 specific gravity should show a urea content close to 0.015, of 1015 specific gravity not less than 0.01, of 1012 specific gravity not less than 0.006, and the color of the urine is at times suggestive, because the normal yellow coloring urochrome is derived from the food proteins, and pale or water-white specimens of satisfactory gravity are usually the result of low-protein or protein-free diet.

With these considerations any deviation of the specific-gravity-salt-urea ratio may be regarded as indicative of a departure from the normal metabolism or diet.

Salt determinations of this kind are so simply and rapidly done that they are made as a matter of routine in our work, but the urea is quantitated only when it is thought to be of particular interest.

Very numerous observations show that when either salt or urea fail or when between them they do not account for the specific gravity, some abnormal constituent is almost always present to make up the difference. Sugar urines, especially those containing the non-reducing sucrose, illustrate this well, but it is in the doubtful albuminurias that the ratio will be seen to be of the greatest service.

The body tissues and fluids require about 0.5% of salt for osmotic equilibrium, and considerable variation in the weight of normal individuals often occurs as a result of water retention brought about by the salt content of the tissues. The urinary salt is regularly reduced in diarrhœa, but runs continuously high in diabetes insipidus, because the kidneys, not secreting urine of normal concentration, demand an abnormal supply of water in order to relieve the body of salt, thereby concentrating the blood plasma, which concentration in turn excites thirst. Edema is at least in part, and probably to a

great extent, a consequence of the efforts of the body to dilute salt, and the present great interest in the plasma chlorides and chloride excretion in general is worth while noting, because of the decided tendency manifested nowadays by practitioners to extend the use of salt-free diets.

When sending for a second specimen of urine, it will be found an advantage to learn the time of day it was voided and the nature of the food eaten at the preceding meal or two. This information, together with the specific-gravity-salt-urea ratio, will be found a surprisingly adequate substitute for the twenty-four-hour specimen we cannot have.

Azoturia is uncovered by the urea estimation, and an excess of chlorides is of no great importance to us, because we do not have to deal with pneumonia crises and sudden reabsorptions.

It may also be pointed out that the use of this ratio is in entire accord with the accepted teaching of Mosenthal that

"The Kidney expresses its diminished power to functionate by fixation of its power of concentration. The normal kidney yields a urine of medium, low, or high specific gravity according to the proportion of fluids and solids that must be excreted in order to maintain the composition of the body fluids at a constant level. The diseased kidney, on the other hand, loses this flexibility, and the power to answer the demand for a more concentrated or a more dilute urine no longer exists."

Following these lines of thought it is advisable in doubtful cases of albuminuria necessitating several specimens to have them voided at different times of the day.

Then, wide ranges of specific gravity have something of a favorable meaning, while a tendency to fixation of the specific gravity, with a range of but a few points, especially if on the lower side of 1020, is at times also suggestive.

Appreciation of the value of all of these and other considerations enhances the necessity and importance of precise specific gravity readings. Consequently, a method was sought which would enable us to get good specific-gravity determinations of the many specimens which sufficed for the other tests, but were insufficient in amount to float reliable urinometers. Every

available type of instrument and apparatus was tried, but none of them proved simple and accurate enough in the hands of the ordinary laboratory help to give results which checked up uniformly.

A description of the specific-gravity Immiscible Balance which has been worked out, with some historical, theoretical and technical considerations and an outline of the experimental work, is available in the Transactions of the American Urological Association for 1920, and additional details will be published later in connection with the specific gravity of the blood, etc.

For the present it will then suffice to show you the apparatus and the method and draw your attention to the design of the urinometers, which will be found unusually free from the tendency to hang to the sides of the jar and very stable and well-balanced. These features, with the new type of scale, permit exceedingly quick and precise readings.

The advances which have been made in modern blood chemistry are worthy of attention, because further developments will undoubtedly lead to greatly simplified technique, requiring but minimum amounts of blood. In fact, by several methods the blood sugar may now be estimated with three or four drops of blood, but such methods are of course impracticable for insurance purposes. Creatinine has little interest for us, because when high, death is already near. Cholesterol results are still somewhat obscure. The nitrogen partition will probably always be too intricate, but it is not at all unlikely that a drop or two of blood will eventually yield determinations of the blood uric acid, and this would afford us practically a certain means of gauging the significance of albuminuria, because a rise in the blood uric acid is the very first tangible evidence of kidney strain or insufficiency, and it is not a test of extreme delicacy, because the kidneys have a functional capacity in excess of ordinary demands, and some degree of nephritis exists before the blood will show evidence of retention.

With a single drop the specific gravity of the blood may now be determined with the Immiscible Balance and studies are

under way which promise results of practical importance. Thus, it is a well-established fact that in the absence of certain diseases the specific gravity of the blood is a definite index of its hemoglobin content. But when the cellular elements are increased, as in leukemia or the polycythemia of circulatory troubles, or when the normal constituents run high, as in diabetes, or when there is retention, as in nephritis, the specific gravity of the blood runs higher than the hemoglobin, and, proportionately to its extent, such a disproportion has clinical significance.

Observations show that the upper normal limit for blood is something like 1065, beyond which a pathological condition is indicated.

The two rival hypotheses which have been trying for years satisfactorily to explain the mechanism of the renal function have given place to a more modern theory, which accepts Ludwig's general scheme of filtration and reabsorption, but supplements it and fills in its gaps. This can hardly be presented without considering the mass of experimental data, so that only a rudimentary outline of its practical relevancy to albuminuria may be attempted.

	Blood Plasma	Urine	Blood—Urine Change
Urea	0.033	2.00	60.
Uric acid	0.002	0.05	22.7
Chlorine	0.410	0.60	1.5

A comparison of the normal averages per 100 c.c. of protein-free blood plasma with those per 100 c.c. of normal urine for urea, uric acid, and chlorine, according to Mosenthal's figures, will serve to show the very different proportions with which these substances occur in the blood and in the urine, and with a consideration of their differences, indicated in the third column of the above table, make it clear that urine is not mere protein-free blood plasma, but that considerable changes in concentration are worked by the kidneys, which involve the expenditure of a great deal of energy. If it be also recalled that the uriniferous tubules are prolongations of Bowman's

(epithelial) capsule, which is in part invaginated by the convoluted capillary tufts from the renal artery, called glomeruli, it is easily understood how the proof is practically complete that the capsule and in part the glomerulus act as filters and that their filtrate is free of the colloid substances (albumin, globulin) which are normally present in the plasma. Therefore, the blood leaving the glomerulus is a concentrated solution of colloids, and must get from the filtrate sufficient of its salts and water to make it an optimum fluid for the body cells. The materials which the body does not need are called *non-threshold* and are excreted in the urine, and they continue to be excreted as long as they are concentrated above a certain level in the blood. The substances which the body uses are termed *threshold* and are reabsorbed by the epithelium of the uriniferous tubules, with the water and salts necessary to restore the plasma to its optimum concentration. The secretion of urine continues only so long as the colloids of the plasma remain below a certain level of concentration, because when the indiffusible colloids cause a rise in the osmotic pressure, the capillary pressure is unable to oppose it. Therefore, practically all of the urea in the blood, being non-threshold, is excreted, but none of the threshold glucose if its concentration remains below a certain fixed level (when above this level, glucose becomes to that extent non-threshold). Thus it is seen that under ordinary circumstances the blood albumins do not get to the kidney tubules at all. When they do, as in acute nephritis or failure of the circulation, the plasma colloids (blood albumins) filter through the capsule only because its permeability is changed as a result of asphyxiation or inflammation, *i.e.*, the reduced amounts of urine in such conditions.

It seems unlikely that a purely glomerular or a purely tubular type of nephritis ever occurs, although the low specific gravities of the chronic nephritic suggest impairment of the reabsorbing mechanism, while the failure to excrete dyes, like phenolsulphonophthalein, suggests disturbance of the filtering apparatus. This altered conception explains why the filtration

of the protein-free blood fluid through the capsule depends upon blood pressure, osmosis, the condition of the filter and the composition of the blood fluid. It is of practical interest, because it clarifies the confusion occasioned by the long and complex nomenclature of albuminuria as found in the books, and makes it clear that almost any circumstance which affects blood pressure, osmosis, nervous innervation, hormones, colloidal diffusion or cellular function may provoke albuminuria.

It likewise suggests the futility of clinging to the older terminology found in the textbooks, such as accidental, physiological, etc., and speaks for a simpler classification, such as the one which has been proposed by Bruce which divides albuminurias into pre-renal, renal, and post-renal.

The pre-renal includes albuminurias due to chilling, posture, heart disease, and other causes. This class might, with advantage, admit of subclassification. The renal class is limited to albuminurias referable to kidney disease, and the post-renal comprises the albuminurias derived from the urinary tract below the kidney.

It seems certain that a better knowledge of the nature of colloids and globulins will eventually put us in the possession of simple differential tests that will enable unerring distinction to be made between some of the non-significant and the significant albuminurias, and it is pleasant to note that Janeway drew attention to the fact that so-called orthostatic albuminurias frequently show a precipitation by acetic acid in the cold (Ott's) test whereas true nephritics show albumin which responds only to the specific albumin tests.

The tendency to rely on the intermittence of an albuminuria as evidence of non-significance is certainly not free from danger, because well-advanced nephritics frequently void albumin-free urine, and this is the more likely to occur when the gravity of the urine tends to run low.

Thus it is a not uncommon observation for some of the definite nephritics who avail themselves of The Prudential Policyholders' Laboratory service to show albumin when the urine has a specific gravity of 1020 or more and to send in

specimens of 1013 to 1016 specific gravity which are practically free from albumin.

When urines contain albumin and pus, if no blood be present, the amount of albumin will afford a definite clue to the origin of the pus. As a practical matter, we are not likely to look favorably on cases showing large amounts of blood or pus, and the albumin-and-pus specimens should never show more than a fairly definite cloud by the heat test. Less than that is a safe indication that the albumin and pus are not at all derived from the kidney, although the microscopical pus runs as high as thirty cells to the one-sixth field. In making this distinction, it should be noted that it is our habit to do the albumin tests with the clear urine above the sediment in the centrifuge tube and the comparative rarity of primary, uncomplicated cystitis is always worth bearing in mind.

Some intermittent albuminurias result from unilateral kidney disease, and of these the cases of intermittent hydronephrosis are quite characteristic, the urine from the sound kidney being well-concentrated and negative, while the specimens coming from both kidneys tend to run lower in gravity and show albumin and often small amounts of pus.

Doubtful albuminuric urines which show a tendency to deep yellow, reddish or brown coloration should always be tested for bile pigments, and Hammarsten's reaction will be found of distinct advantage, because it frequently shows the presence of bile pigments when other tests turn out negatively. It is certainly affected to a lesser extent than the other tests by indoxyl, conjugates, extractives, etc.

In this connection it is worth recalling that the presence of bile pigments in the urine is often an indication of other disturbances of the liver function than biliary obstruction and it may be observed that they are excreted quite regularly, but perhaps in small quantities, in cases involving blood destruction (internal hemorrhage, etc.), marked intestinal putrefaction, chronic lead and other poisoning, chronic passive congestion, especially, and parenchymatous disease of the liver (cirrhosis, etc.).

Their appearance in the urine, when associated with obscure or doubtful features, may therefore be regarded as pathognomonic of impairment, and the close relationship with hemoglobinuria is likewise of interest, because an occasional one of the simple and slight albuminurias is undoubtedly due to the presence of hemoglobin resulting from minor hemolyses. Such urines do not always attract the attention of the examiner because, unlike hematurias, they are often clear when fresh.

Although rarely, lymph may enter the urine as a consequence of unimportant conditions and give rise to marked albumin reactions. Lymphuria may be suspected particularly in individuals with enteroptosis, or movable kidney, and the appearance of drops of fat on the surface of the urine or the presence of lymphocytes furnishes a means of identification. These instances have nothing whatever to do with chylous specimens and are probably more frequent than is commonly believed, and may account for some of the postural cases.

The lack of a simple and rapid method for quantitating albumin has handicapped insurance urinalysis as well as clinical. Thus, the literature gives several figures for the upper limit of so-called physiological albuminuria, and of these that of Senator is the more generally accepted, which holds that more than 0.5 grams of albumin per liter of urine is not physiological. The very minute amounts of albumin which are present in normal urine are not all likely to perplex any one, and in connection with albuminuria an exception should be taken to the use of the word physiological, because there is probably no such thing as a physiological albuminuria.

The fact that autopsy material shows so many practically normal kidneys in individuals of middle age or older, while perfectly normal kidneys are of extreme rarity, is suggestive on this point.

Thus, an albuminuria resulting from the chilling and jolting of a long automobile ride and that found in some adolescents as a result of masturbation are not pathological in the sense that they denote disease and they are certainly not physiologi-

cal in the sense that all normal individuals develop albuminuria as a consequence of such causes.

The exceedingly numerous and varied circumstances which, it is known, may give rise to the so-called physiological albuminurias are in the last analysis circulatory, digestive, or nervous strains, or combinations of these, and might more truthfully and suggestively be termed "strain" albuminurias and be given a place among the pre-renal albuminurias in the previously mentioned classification.

An investigation of the available means for quantitating albumin discloses that none of them is reliable or simple enough for any but exceptional use.

The nephelometric method of Folin appears to be the most practicable, and some experiments were undertaken with a view to simplifying it. These developed the fact that reasonably accurate quantitations are possible by making a heat test in the usual way and inspecting a fixed and standardized object, such as a cluster of black dots on a white background, through a column of the cloudy urine; the height of the column through which the object remains visible determining the amount of albumin. Such a method is simple and rapid, but the colors of the urine furnish an interfering element, which, however, may be without a practical effect on the results.

Our plans to construct such a simple albuminometer were desisted from, at any rate for the time being, when it was realized that a more accurate and just as simple method could probably be worked out with the specific-gravity Immiscible Balance.

If one makes the heat test in the usual way and takes the specific-gravity with a specific-gravity balance, or hydrometer, scaled in tenths, before and after removing the coagulated albumin and multiplies the difference in specific-gravity by Zuhor's factor of 400, a result is attained in terms of number of grams of albumin to the liter of urine. It has been impossible to complete all of the necessary experimentation in time for this meeting, and a later communication will deal more extensively with these methods.

Persistently high blood pressure, when associated with albuminuria, is of course indicative of actual impairment, but when neither the blood pressure nor the albuminuria is persistent, efforts to determine whether the blood pressure be due to spasm or fibrosis are likely to shed light on the significance of the albuminuria, and this applies with especial force to the cases in which blood pressure and albuminuria records are combined.

Slight and recent colds or sore throats, and especially pharyngitis when so mild as to cause no symptoms, at times account for albuminurias which may persist for weeks, while those due to too much golf or dancing, or other forms of overexertion, as well as those dependent on dietary excesses, usually disappear in a few days or even hours. Albuminuria, with or without casts, is a frequent result of focal infection. This type usually disappears promptly when such infection is cured. Inspection of the teeth and tonsils seems indicated and the propriety of advising such applicants and postponing action until they have had the benefit of appropriate treatment is worthy of careful consideration from several angles.

When associated with cardiac or circulatory conditions, the nature of the albuminuria is usually disclosed by a functional test like the one discussed in connection with acidosis.

Maclean and Wesselow lately direct attention again to the facts that albuminuria is now always indicative of renal disease and that it is much more common than is generally believed.

They employ the inability of the diseased kidney to excrete urea at a high concentration as a test of kidney efficiency by quantitating the urinary urea an hour or two after the ingestion of 15 grams of it.

An interesting recent report in the *Dental Cosmos* by Ferris, of the examination of the saliva of one thousand individuals is suggestive, because the findings of urea and aceto-acetic acid in some of them led to the discovery that they were definitely diseased. The possibilities of the saliva as an indicator of disease seem worth while investigating, because the technique need be purely qualitative and of extreme simplicity.

Not only for its very important aid in solving the meaning of many albuminurias, but also because of the other valuable knowledge which it affords, the microscopical examination of the urinary sediment has come to be indispensable, and it is a very regrettable probability that under the stress of routine work the tedious searching for casts develops a tendency to ignore some of the finer distinctions, which yield valuable and specific diagnostic information.

Thus, the epithelium of the prostatic ducts is larger and cuboidal, while that from the seminal vesicles is smaller and columnar, and usually shows pigmentary granules, which the prostatic epithelium never does. The cells from the renal pelvis and ureter are sometimes caudate and distinct from these, and the epithelium from the uriniferous tubules is always smaller and partly flat to cuboidal and columnar.

These latter cells may be studied on casts, and if present in numbers or groups, are pathognomonic of a desquamative renal process, even if no casts at all be present. The relationship of the various types of epithelium to transitional and atypical forms, and especially to connective-tissue elements and the leucocytes or red cells, often gives very definite information. Undoubtedly, a good microscopical examination under the routine conditions of insurance work is difficult to have, although the search for casts is usually so well made that the significance of certain types of cylindroids is lost sight of.

With the conviction that more discriminating microscopy would frequently result in quicker decisions and fewer specimens, the matters of eyestrain, fatigue, loss of visual acuity, ocular discomfort, nervousness, headache, etc., which are very trying elements in the practical matter of getting the work done, were studied with a view to the possibility of their amelioration by working out a means for rendering the work less trying, so that better and easier microscopy, with the expenditure of the same or even less effort, might be available.

Consideration of all of the elements entering into microscopy, especially the strong preferences lately manifested for binocular microscopes and artificial illumination, in conjunction

with the eye-troubles of arc-light workers and the difficulties encountered by Prof. Dimmer in his experimental efforts to photograph the retina, led to the conclusion that six or seven different influences were responsible for the physical difficulties connected with the constant use of the microscope, and these will be treated of at length in another paper, which will also deal with the details of theory and construction, which are too lengthy to find a place here.

Such an arrangement is adaptable to other types of optical instruments, such as colorimeters, etc., and it is hoped that the combination with the microscope will render microscopy no more of a strain on the eyes than ordinary clerical work and that it will in practise prove that anything which is conducive to freedom from strain and to comfort improves accuracy.

Some of the conditions of living responsible for sugar in the urine are changed and intensified by life under Prohibition, and the high cost of sugar at times is a complicating factor. Copper-reducing urines are found more frequently than formerly and constitute, of course, a direct reflection of the increased consumption of all kinds of sweets. Many who were not accustomed to use alcohol are eating and drinking more sweets, and it is certain that a larger variety of sugar and sweets, with artificial coloring matters in drinks and confections, is used than ever before.

The carbohydrates, sugars, and starches are chemically ketone or aldehyde derivatives of the higher alcohols, and their close relationship probably accounts for the turn to sweets as well as the habit of "taking something." The consequence is an increase in many types of glycosurias, especially what might be called "imitation" glycosurias, *i.e.*, those in which the reductions are due to other substances than glucose.

It would be a mistake to yield entirely to the theory that just because a person has indulged in sweets the sugar found in his urine is accounted for, and therefore negligible. On the contrary, it will most likely be nearer the truth to reckon that he is living closer to his sugar-tolerance limit than is good for

him, because it is in just such instances that slight or chance excesses bring about the excretion of sugar in the urine.

This, with the established experience that individuals who continue indulgence in carbohydrates after overstepping their tolerance limit develop into diabetics, points clearly to an actual increase of diabetes. Bringing this and tendencies to drug-habituation, clandestine and poison tipple, and obesity, Prohibition may have come as a lesser evil, but certainly not as an unmixed blessing.

Intrinsically there is no physiological or pathological difference between the man who occasionally showed sugar in his urine before Prohibition became effective and the man who does the same thing since then, except that the latter probably takes more of the carbohydrates and is therefore living closer to his carbohydrate-tolerance limit. This has a significance for us and is somewhat compensatory, because these individuals are the more likely to give positive responses to assimilation tests, even to those of lesser severity, and the assimilation or tolerance test appears to be not only the most practicable, but practically the sole means at our command for resolving whatever doubt may arise with regard to the insurability of an individual glycosuric.

Its employment is therefore bound to become more frequent than formerly, and it would be well worth while for this Association to consider the advisability of having a committee go into all the questions involved, with a view to standardizing the test for insurance purposes and revising the terminology of diabetes.

The assimilation test is not quite a test of the limit of saturation or tolerance, and the word "limit" as used in the books is something of a misnomer, because it implies that beyond such a "limit" the organism cannot deal with carbohydrates, which is certainly not the case, for if greater amounts of carbohydrates be taken, only small traces of the excess appear in the urine. Therefore, the amount of sugar found in the urine as the result of an assimilation or tolerance test is not a strict criterion, and mere traces may be just as significant as larger

amounts, although this may seem somewhat contrary to the general impression.

As practical matters connected with this test it should be noted that living in a heated atmosphere and much muscular work strongly tend to raise the ability of the body to assimilate sugars, and that the presence of food with the test sugars likewise tends to deter their excretion in the urine. On the other hand, the absence of food, with the presence of considerable amounts of fluids in the stomach, tends to help their excretion in the urine, and this probably accounts for the fact that we are meeting now, not very infrequently, a type of specimen which was formerly considered extremely rare, *i. e.*, low-gravity specimens showing definite sugar reactions.

Renal impermeability to glucose or abnormal motility of the stomach, when they are present vitiate the test even when it is carried out under otherwise ideal conditions, and their interference in some of the cases is sure to be misleading.

Though the tolerance test must serve our purposes, as we have no better one, it is well to remember that the typical onset of diabetes in all but the most acute cases is by a gradual rise of the blood sugar, traceable through months in both animals and patients before glycosuria appears; according to Allen, there is generally a continuous hyperglycemia in the following stage of occasional or "alimentary" glycosuria when we encounter the cases, and after that continuous glycosuria.

The assimilation test was originally therapeutic and served as an indicator of dietary restrictions, but its diagnostic value became evident when it was realized that the inability of an organism properly to assimilate the carbohydrates of the usual diet was characteristic of early diabetes. In line with this teaching, the appearance of appreciable amounts of sugar in the urine when there has been no overindulgence in sweets points to impaired carbohydrate metabolism.

Such cases deserve critical consideration, because many of them may be safely disposed of without an assimilation test. The majority of them will turn out to be diabetics, but some of them will be found to have a more or less temporary, and per-

haps even trivial digestive disturbance. This is also very likely to be the case when other sugars than glucose are found in the urine.

Such glycosurias have nothing whatever in common with those associated with hyperglycemia and diabetic metabolism, but are altogether due to a temporary vitiation of carbohydrate digestion or absorption resulting from gastric or intestinal disturbances or medication. These are safe risks when the visceral condition is not chronic, and as a practical matter when sending for second specimens specific inquiry should be made with reference to indigestion and medication and enough time allowed for the digestive condition to right itself before examining further specimens.

Such cases may show sugar in several specimens and therefore appear distinctly unfavorable, but a week or two later the most rigorous assimilation or even a blood test will show them to be perfectly good risks. Picnics, outings and traveling often appear in causative relation to this type of glycosuria. A very interesting group of such cases was uncovered some time ago among West Point cadets who were examined on holidays or the days after.

Carbohydrate food reaches the duodenum as undigested starch, glucose and maltose, the latter disaccharid representing the starch affected by ptyalin digestion. In the duodenum, amylopsin hydrolizes the remaining undigested starch through dextrin into maltose, which is in part also derived from the unchanged sugars that may be in the food, such as cane sugar, maltose, or lactose.

Normally, none of these is absorbed at this stage of digestion, but if in high concentration, absorption into the blood and excretion in the urine take place, thereby adding a confusing element to our work.

The intestinal juice, with its inverting enzyme for each disaccharid, completes the digestion of the carbohydrates into the monosaccharids, glucose and fructose, which are directly absorbed into the blood of the portal system. From this it will be seen that cane sugar in excess is excreted in part un-

changed and in part as glucose, giving rise to what might be called the typical alimentary glycosuria.

The variability of the relationship between the blood thresholds and the sugar in the urine is of clinical interest, but of no practical use in our work at present, because postprandial hyperglycemia is the very earliest sign of diabetes, and the blood sugar may be having a continuously high threshold without showing any sugar at all in the urine.

Although not at our disposal, the extension of the clinical use of blood-sugar determinations, as well as the effects of the modern starvation treatment, is bound to exert very favorable influences on the mortality from diabetes.

Certain drugs provoke glycosuria, but much more important are the glycosurias resulting from nervous strain, emotion, pain, fear, anxiety, minor shock, etc. It is certain that glycosurias are often confounded with nervous glycosuria, which as a type accounts for the cases wherein isolated, and even frequent, findings of sugar are made in the urines of individuals who when tested reveal a normal carbohydrate tolerance.

Cannon and others have demonstrated that pain, excitement, emotion, etc., excite an increase in the output of adrenal secretion, and very lately Achard has shown that the adrenal secretion not only produces but also prolongs hyperglycemia.

That this type of glycosuria is not entirely evanescent and benign when periodic recurrences of the causative factor are to be expected is strikingly witnessed by the high incidence of diabetes among locomotive engineers, train-despatchers, sea captains, etc., and it is interesting to note that the same causes predispose to arteriosclerosis and apoplexy, with which diabetes is so often associated. Some occupations, such as chauffeur, motorman, or promoter, etc., are apt to be extra-hazardous when associated with a glycosuric tendency.

A good example of such a glycosuria recently occurred in the case of a business executive, who after a sleepless, expectant night was examined in his office in the early morning while rushing things so that he could go to a near-by city to bring his wife and new baby home from the hospital. Some individ-

uals in times of financial worry will show sugar in the urine for months at a time.

This nervous type of glycosuria is important, because all of the endocrine secretions more or less affect carbohydrate metabolism, and it is of particular theoretical interest in connection with the modern experimental work which seeks to learn why a substance, like glucose, which acts, as it were, like ready cash in the transactions of the organism, fails to pass into the urine under normal conditions.

Allen has observed that glucose, when injected intravenously, causes glycosuria and diuresis, whereas injected subcutaneously or taken by mouth it does neither. The most probable explanation is that the glucose is not in a free state in the blood, as has been believed, but exists in the blood in combination with some substance of colloidal nature that is closely related to the internal secretion of the pancreas, which is, when deficient, regarded as diabetes.

Our primary practical problem then is to be sure that in a given case we are dealing with glucose and not with some other reducing substance in the urine, and it is well to realize that other reducing substances are frequently encountered and that the copper tests are not specific for glucose.

They nevertheless suffice to demonstrate the absence of sugar and to indicate the probability of its presence in pathological amounts.

Comparative tests made on over two thousand urines, making the different tests on the same specimens just as they came into our laboratory, inclined us to prefer Benedict's qualitative solution, on account of its stability, simplicity and relative freedom from misleading reactions. It may be a shade more delicate than some of the other tests, but it is not affected by many drugs, uric acid, creatinine and the aldehydes, all of which reduce Fehling's solution. And when formalin is used for preserving the urine, it has been found decidedly safer than other copper tests.

The highest figure found in the literature for normal urinary sugar is 0.03 %. The reducing power of normal urine is,

however, often greater than this, on account of the presence of other reducing substances than glucose in normal urine. Therefore, in terms of glucose reduction 0.08% may safely be taken as the upper limit of the reducing power of normal urine.

A reducing power beyond this is abnormal, although not necessarily significant of a pathological condition.

It is demonstrably certain that neither Benedict's nor the other copper tests will give typical reactions with normal urine, and the partial, atypical and puzzling reactions are generally due to other substances than glucose, although glucose may at times exist in combination with some of them, *i.e.*, the chocolate-like precipitate of alkaptones.

In our work eight or nine drops of urine are added to a few c.c. of Benedict's solution and left in a calcium chloride water bath for four minutes. If the quantity of glucose be less than 0.3%, the precipitate forms only on cooling, and it is the bulk and not the color of the precipitate that denotes a positive reaction.

If the copper test turns out to be positive, further steps are necessary, in order to make sure that the reducing substance is glucose. Of the many reducing substances which may be encountered, glucose is the only one that ferments, rotates polarized light to the right and gives typical crystals with the phenyl-hydrazin test, and it has been found simpler and more satisfactory to confine the process of identification to these three tests than to complicate matters by making the more or less specific tests for each of the other various reducing substances which may be met with in urine.

The technical requirements of Cipollina's, or better, Kowarsky's modification of the phenyl-hydrazin test can be fulfilled in a minute or two, although fifteen to twenty minutes must be allowed for it to cool before the osazones are distinguishable by a glance through the microscope. But one or two c.c. of urine are required and the presence of typical crystals defines the urine as non-physiological, because the phenyl-hydrazin test, at its best, is not as delicate as the copper tests, and when

performed with minimum amounts of urine it is rendered still less sensitive.

With experience glucose, maltose, lactose, and pentose, when they crystallize may be differentiated by this test, and it is hoped that other differentiations will eventually be possible.

The failure to form a typical glucosazone or fructosazone is definite proof that the specimen does not contain glucose or fructose, and the test would be specific for glucose, were it not for the fact that the osazone of fructose (levulose) is apparently identical with that of glucose.

Our attention has recently been drawn to a modification of the phenyl-hydrazin test claimed by Porcher to make this test specific for glucose. The modification or, rather, addition consists in making the test in the usual way, cooling quickly, centrifuging, pouring off the supernatant fluid, adding water to the crystals and boiling again. If the crystals do not dissolve, it is said that they are definitely glucosazone.

If this test can be proved to be reliable, it has the distinct advantage of not only being specific for glucose, but also of rendering unnecessary the use of the microscope for identifying the osazones. While apparently predicated on the differences in melting-point of the osazones, it has not yet been settled to our satisfaction that the test is capable of differentiating glucose and fructose, although further experience may change this view.

In his latest edition Hawk gives the phenyl-hydrazin test as specific for glucose in the absence of a positive resorcinol-hydrochloric acid reaction, *i.e.*, Seliwanoff's test for fructose.

All fruits and vegetables are rich in fructose or the pentoses and for that reason alimentary pentosuria, and fructosuria, the latter following the former in frequency, occur next in frequency to the glucosurias.

The optical activities of glucose (dextrose) and fructose (levulose) afford a means of specifically differentiating these two sugars that is very rapid and easy and on the whole probably safer than Seliwanoff's reaction, although it must not be forgotten that some of the compounds of glycuronic acid and invert sugar also rotate polarized light to the left.

A simplified half-shadow instrument which permits the use of a short tube, like the Goerz saccharometer, will be found satisfactory, and if this is combined with the advantages of the arrangement mentioned in connection with the microscope, the delicacy and rapidity of the polariscopic method may be decidedly improved.

Urines containing sucrose (cane sugar) are non-reducing, high in gravity and strongly dextro-rotary, and polariscopy or inversion will serve to clear up some high gravities or check up sucrose test meals.

For quantitating sugar, titration is not as expedient as either polariscopy or fermentation, and of the two latter polariscopy gives reasonably accurate and much quicker results, although fermentation is also in general use in our work.

When done with the usual commercial yeast, fermentation often leads to queer and disappointing results. Sugar, inverting bacilli and enzymes, like carboxylase, alone or in combination with each other, and still other impurities occur in commercial yeast and at times produce fermentation in perfectly normal and sugar-free urines. On the other hand, slight amounts of fermenting sugars, like glucose, sometimes fail to show, because of the absorption of the gas.

If a good strain of saccharomyces apiculatus can be procured and maintained in strength, more reliable fermentation results are possible with the employment of Lohnstein's precision tubes. The graduations on the Einhorn tubes found in the market are so variable that at best they seem to be but relative, rather than exact.

When only a small quantity of urine, even less than ten drops, is available for sugar quantitation, recourse may be had to the specific-gravity immiscible balance by taking the specific gravity before and after fermentation and multiplying the difference in gravity by Robert's factor of 234.

It is possible that the density difference is a more exact criterion than the collection of gas in the arm of the usual fermentation-tube, and some workers have given it preference and claim for it an accuracy within 0.1%. This feature is at

present under investigation, but because of difficulty in procuring the necessary instruments, the results will have to be communicated at some later time.

The fugitive acetone bodies when present are extremely suggestive in connection with sugar in the urine and would most likely be found more frequently if the urines were examined for them when fresh. The extreme simplicity of the ferric-chloride reaction should make it easily manageable by examiners, but it is well worth doing in the home-office laboratory, because it occasionally uncovers medication which the applicant is taking. Some definite impairments have been brought to light as a consequence of inquiries directed to account for definite changes of color, and these are invariably controlled by testing the boiled as well as the unboiled urine.

Heavy or obese individuals are more inclined than others to excrete acetone bodies not only when the diet is restricted, but particularly when subject to "Diabete Gras," or so-called masked diabetes. In the earlier stages of this type of the disease the carbohydrates are vicariously converted into fats, instead of sugar, and the diabetes is generally well advanced before glycosuria intervenes.

Lipemia is a feature of this condition and acetone bodies in conjunction with traces of fat in the urine are diagnostic. Traces of fat in the urine of obese individuals even without acetone bodies should be regarded as significant if the weight tends to increase and the family history is at all doubtful and they are not taking oily medicines.

The prevailing view of acidosis is now undergoing revision, as a consequence of the brilliantly successful applications of the data yielded by researches into the blood-respiratory relationship, which have not only taught splendid means for combatting acapnia, caisson disease, and shock, but which during the war also proved preëminently useful in such practical matters as selecting fit aviators and constructing efficient gas-masks.

Of these lessons it is particularly desired to stress the fact that muscular exertion or oxygen deficiency cause hyperpnœa,

or overbreathing, and Haggard and Henderson, of Yale, go so far as to postulate that a respiratory factor is produced in active muscles by muscular activity which produces hyperpnœa, when carried in the blood to the respiratory center. Be that as it may, hyperpnœa lends itself admirably to distinguish lungs, bloods, and circulations which function well from those that do not.

Overbreathing is a familiar phenomenon, even to laymen, but its diagnostic employment seems haphazard and usually incidental to exercising persons for the purpose of bringing out a heart-murmur.

Observations show that lung conditions like emphysema, in which oxygenation is decreased, circulatory conditions like myocarditis and arteriosclerosis, in which oxydation is diminished, and blood conditions like acidosis or anemia, in which the oxygen-carrying power is reduced, tend strongly to minimize the amount of muscular activity needed to produce overbreathing, and a functional test based on such grounds may easily be performed by measuring the degree of muscular activity it takes to produce hyperpnœa with a tire-pump or similar exertion.

Combined with the "jump" and "come back" time of the pulse a favorable outcome of the test is definite evidence of good function, and as such acts to dissipate doubts and obscurities when the age, build, and other features of the case are judiciously considered.

In conclusion it is to be mentioned that information concerning grossly abnormal fluid consumption or urine excretion as related to fads, thirst, nocturia, or frequency is usually obtainable in all of the questionable cases and helps to complete the picture.

Correlative to actuarial experience, as it is, and with its inherent business limitations, Insurance Medicine is a specialty having its own peculiar problems to solve, and it may be pointed out that the efficient selection of the best means for clearing up a given doubtful case will go a long way towards economy of time and expense in Field and Home Office. To

this end the closest possible Laboratory coöperation is desirable.

Dr. Weisse—We are much indebted to Mr. Wolf, the Chemist of the Equitable Life Assurance Society, for his most interesting paper on the tests for sugar. The question of glucose or not glucose is one which with most tests is sometimes a very difficult one to decide, and I think that we have all been puzzled by the many peculiar reactions which we found while so many substitutes for sugar were being used during the war and up to the present time.

A STUDY OF THE MORE COMMON METHODS USED TO DETECT SUGAR IN URINE, WITH SPECIAL REFERENCE TO THE TESTS EMPLOYED IN THE LABORATORY OF THE EQUITABLE LIFE ASSURANCE SOCIETY

By August S. Wolf, Ph.G.

Is there sugar in the urine and, if so, how much?

That is the question which has been asked us and answered 500,000 times in the last 20 years, and 35,000 times during the last 12 months. Thus, you can readily see that this has been an ever present stimulus to us to perfect rapid, simple, yet accurate methods of determining the presence, and if present, the amount of sugar in the urine.

The subject matter of this paper is based upon extensive experimentation and observation, as well as information gleaned from other physiological chemists. It is not my intention to condemn any of the more common sugar tests, but rather to place before you certain tests, which, from my own twenty years' experience I have found to meet the particular requirements of a Life Insurance Laboratory. The volume

of specimen submitted to us for complete chemical and microscopical examination is very small, varying from one quarter to one ounce. That, along with the accuracy, time, labor, expense, and ease of the procedure have all influenced us in our decisions.

All of our experimental work has been carried on with three objects in view. Our first was to find a simple qualitative sugar test, wherein there would be used a reagent which was not too delicate, and still was sufficiently sensitive to detect 0.25% of sugar; a reagent which was least influenced by interfering substances which have no pathological significance; in this connection, an investigation of a hundred specimens which did not reduce Haines' solution, showed a sugar content varying from 0.05% to 0.25% which amounts are considered negligible by our Medical Director. The second aim was to find a test to identify the sugar which was causing the reduction. Our third aim was to perfect a rapid, accurate method of quantitating the amount of sugar present.

The first step toward our goal consisted of making qualitative comparison tests on 2500 specimens of urine. In accomplishing this, we subjected the specimens to the following tests: Fehling's, and two of its modifications, Benedict's, Nylander's, Haines', and the phenylhydrazine test; and in conjunction with them, in some instances, the fermentation, polariscopic and the spectroscopic tests. The results of these experiments have lead us to adopt a modified Haines' test for our use in preference to all others, with Squibb's modification of Fehling's our second choice. The subsequent paragraphs will give a survey of our findings and conclusions.

Nylander's bismuth reduction test was one of the first to be eliminated from our consideration. It was found to react positively not only with a negligible amount of sugar, but also with albumin and sulphur-containing compounds, which so often are present in the urine. This naturally gave a number of indefinite and false reactions. The time devoted to testing for and removing of any albumin present is begrudged in any

laboratory. Another objection to this test is that it requires five cubic centimeters of urine.

What many writers give as an advantage of Benedict's modified, permanent reagent, we found was a disadvantage, viz., its ability to detect very small quantities (0.05%) of sugar. In our Life Insurance work we do not want such a supersensitive reagent.

Next in our comparative tests came the original Fehling's, and then two modifications of it, in which varying proportions of reagent and specimen were heated to the boiling point. When equal parts of freshly mixed Fehling's solution and of urine were used many questionable reductions occurred; some of which were due to excessive amounts of uric acid or creatinine. By using two parts of mixed Fehling's to one part of urine we found that most of those indefinite reductions were avoided, and only those titrating about 0.3% or more occurred, which is really delicate enough. The best proportions to use are those given by E. R. Squibb which are as follows: two cubic centimeters of mixed Fehling's, two cubic centimeters of water, and one cubic centimeter of urine. The reductions secured here were very similar to those given by modified Haines' solution. Preference was given to the Haines' test because the reagent consists of one solution, requires fewer chemicals, is cheaper, is easier to make up, keeps indefinitely, and requires less measuring in performing the test.

The modified Haines' test is very simple and reliable. To perform the test, seven drops of urine are added to five cubic centimeters of modified Haines' solution, the tube shaken and gently heated to the boiling point. A greenish, yellow, or orange color developing before the mixture has cooled, indicates the presence of some reducing substance, probably sugar. To determine whether the reduction is due to sugar or some other reducing substance we make a phenylhydrazine test on the specimen. Before proceeding to the sugar differentiation let me speak more fully of the modified Haines' solution, its composition, and why we prefer it to the other qualitative sugar reagents. To give us more accurate results we have

modified the original Haines' solution, till now its formula is as follows: Solution A, consisting of copper sulphate 35 grams, water 1600 cubic centimeters and glycerine 160 cubic centimeters; Solution B, saturated solution sodium hydroxide 70 cubic centimeters, to which is added water sufficient to make 2000 cubic centimeters. Add B to A and mix. The sensitiveness of the Haines' solution, as well as other alkaline copper solutions, depends greatly upon the amount of alkali in it; too much alkali decreases, while too little increases the sensitiveness. Both sodium and potassium hydroxides contain anywhere from 5% to 15% impurity. This can be removed by making a supersaturated solution consisting of equal parts of water and alkali in which case the impurities are thrown down by mass action and the clear supernatant fluid will contain the hydroxide in a pure form. This clear saturated solution is used in making up the Haines' modified reagent. The glycerine is used to hold the copper hydroxide in solution, and is not as prone to decomposition as are the salts of the organic acids when used for the same purpose, as, for instance, Rochelle salts which enters into the composition of Fehling's solution. The marked value of this modified reagent is that it is dependable and stable, and is so adjusted that when definite quantities of urine and reagent are mixed, and heated to the boiling point, no reduction will take place unless the specimen contains 0.25% of sugar or its equivalent. An investigation of 14 specimens, which either did not, or else did very slightly reduce Haines' solution, and which had reduced Fehling's, Benedict's and Nylander's. and had given a reduction with ammoniated copper solution varying from 0.2% to 0.35% of glucose, brought these results; each specimen was found to contain abnormal amounts of either uric acid, creatinine or both, one an excess of glycuronic acid and another contained pentose. This would indicate that although our modified Haines' solution is slightly affected by uric acid, creatinine, and glycuronic acid, it is no more sensitive than the reagents mentioned above. To facilitate and standardize our measurements we use a glass-bulbed, rubber-nippled pipette graduated for 7 drops or ½ c.c.

urine, and use Pyrex glass test-tubes which are ringed at 5 c.c., to hold the Haines' solution.

Having chosen a test whereby a reduction of 0.25% sugar could be found, our next aim was to find a method of determining whether or not the reduction was due to sugar. To do this, we used phenylhydrazine. The test is performed as follows: to a test-tube add 0.1 gram of phenylhydrazine hydrochloride, 0.5 cubic centimeter of a 50% solution of sodium acetate, and about one cubic centimeter of urine. Heat over free flame, and then in boiling water for 30 minutes. At the end of that time, allow it to cool, and examine a drop of the mixture under the microscope. Various sugars form definitely characteristic crystals called phenylosazones such as phenylglucosazone, phenylpentazone, etc. In case sugar is not responsible for the reduction, the osazone will not be formed. Glucose forms fine, straight needles lying in sheaf formation. Pentose generally forms very thin wavy crystals which may or may not be in sheaves. Whenever there is doubt as to whether an osazone be glucose or pentose we always perform a Bial's test. If a grass-green color appears in the Bial's test, extract with amyl alcohol and look for an absorption band in the red near the yellow in the spectroscope. In all our experience with the phenylhydrazine test, we have rarely found it to form phenylglucosazone unless glucose was present in 0.25% or more, and these exceptions occurred in low gravity urines, to which significance could be attached.

Having been successful in determining the presence of sugar, our third aim was to find a simple, accurate way of determining the actual amount in the urine.

Polariscopic determinations are accurate provided polarizations are made before and after fermentation. This, of course requires time and a larger amount of urine than needed when titrating with ammoniated copper solution. If the determination is made without fermentation, lower readings will be obtained in many specimens on account of the presence of levorotary substances.

Another identification and quantitative test which is exten-

sively used is fermentation with yeast. We have not adopted this method because it is invalidated by certain preservatives, takes too much time, and too large a quantity of urine. There is also doubt as to the accuracy of the final readings on account of the absorption of the carbon dioxide by the urine, thus causing the possibility of not getting visible gas formation when small amounts of sugar are present.

The original method of quantitating sugar with Fehling's solution is a good one, but, requires too much time and too large a quantity of urine to make it practical for our everyday use. However, Dr. Rogers of the New York Life Insurance Company has devised a simple method using Fehling's solution for approximating the amount of sugar. The test is as follows: "In using a pipette, always hold it in a vertical position so that the drops may always be of the same size. Drop into the test-tube eight drops of Fehling's solution. Add to this in the same way eight drops of water. Boil in Bunsen flame or over a spirit lamp. If the mixture retains its transparent color, it may be used for the test. If it becomes discolored on boiling, it should be thrown away and fresh Fehling's solution obtained. To the hot mixture, add sixteen drops, and no more, of the urine to be tested. Bring to a boil. If, after standing for five minutes, no discoloration takes place, the urine is free from sugar. If sugar is present, the mixture becomes opaque and of a greenish, yellow, or reddish color, according to the amount of sugar present. In order to determine, approximately, the amount of sugar present in any specimen which shows a reaction, prepare a fresh test solution in the manner described above, bring it to a boil and add to it a drop of the urine, heat the solution, add another drop of urine, heat it again, and so on until a reaction occurs." The number of grains to the ounce and the percentage content of sugar are mentioned in a table. I will mention the percentage amounts only, which are as follows:

1 drop of urine indicates	3% or more of sugar
2 drops of urine indicate	1 7/8% or more of sugar
3 drops of urine indicate	between 1% and 2%
4 drops of urine indicate	0.625% to 0.83%

5 drops of urine indicate	about 0.5%
6 drops of urine indicate	about 0.4%
7 or 8 drops of urine indicate	about 0.3%
9, 10, 11 or 12 drops of urine indicate	about 0.2%
13 or 14 drops of urine indicate	about 0.1%
16 drops of urine indicate	about 0.05%

Dr. Rogers desiring an opinion regarding the value of the method, tests were made by us on ten urines containing known amounts of sugar. A portion of each specimen, and directions for performing the test were give to two operators who were not acquainted with the amounts of sugar present. A comparison of the results in the following table indicates that the method can satisfactorily be used for an approximate estimation of sugar.

Operator A found	0.50%	B found	0.50%	Amount present	0.45%
Operator A found	3.00%	B found	3.00%	Amount present	3.60%
Operator A found	0.20%	B found	0.25%	Amount present	0.35%
Operator A found	0.50%	B found	0.75%	Amount present	0.60%
Operator A found	0.20%	B found	0.25%	Amount present	0.25%
Operator A found	0.50%	B found	0.50%	Amount present	0.55%
Operator A found	1.50%	B found	1.50%	Amount present	1.00%
Operator A found	0.10%	B found	0.10%	Amount present	0.25%
Operator A found	1.50%	B found	1.50%	Amount present	1.00%
Operator A found	0.20%	B found	0.25%	Amount present	0.35%

Where Haines' solution is used to test qualitatively for sugar, it can be modified by the addition of ammonia so that an approximate determination, similar to the one mentioned by Dr. Rogers, can be made. With a pipette held vertically, drop into a test-tube 20 drops of Haines' solution, 20 drops of concentrated ammonia, bring it to a boil and add to it a drop of the urine, heat it again, add another drop of urine, heat it again, and so on until the mixture becomes colorless. The sharply defined colorless end point of this ammoniated Haines' solution is very easily read. The percentage of sugar present is determined by the number of drops of urine used to bring about the decolorization of the reagent:

1 drop indicates		2.00% or more of sugar
2 drops indicate		1.00% of sugar
3	" "	0.70% " "
4	" "	0.50% " "
5	" "	0.40% " "
6	" "	0.35% " "
7	" "	0.30% " "
8	" "	0.25% " "

For a more accurate method we tried out Benedict's quantitative method and found it satisfactory as far as results, but not suited to our use for several reasons. The reagent is expensive, consisting of five chemicals, one of which potassium thiocyanate, has been practically impossible to secure the last few years. The Presbyterian Hospital, however, has been substituting the sodium salt for that of the potassium one, with apparently the same result. For each determination a large amount of reagent, as well as a large volume of urine is used and the procedure takes longer than by titrating with the ammoniated copper solution of which I am about to speak.

We have, for the past 15 years or more, been using a very satisfactory method of quantitating sugar in urine. This is my modification of Pavy's ammoniated copper solution. The procedure is just the opposite to the original Pavy method inasmuch as the reagent is added to the urine instead of the urine to the reagent; this necessitating only one cubic centimeter of specimen for a determination. The modified solution has the following formula; Solution 1, copper sulphate 10.4 grams, to which add enough water to make approximately 200 cubic centimeters; Solution 2, saturated solution of sodium hydroxide 70 cubic centimeters, to which, when cool, add 200 cubic centimeters of glycerine and 500 cubic centimeters of strong ammonia. Add solution 1 to solution 2 and then enough water to make 2000 cubic centimeters. The method for quantitating is as follows: Exactly one cubic centimeter of urine is measured with an Ostwald pipette into a porcelain dish, and about ten cubic centimeters of water added to it. Heat to boiling, and while the mixture is boiling, add slowly from a

burette (for convenience we use a Squibb's automatic burette connected with a suction pump) the copper solution until a faint blue color remains, or in other words, does not disappear upon further boiling. That is the end point of the reduction. The percentage of sugar is read directly from the burette. Each cubic centimeter of copper solution used is equivalent to 0.1% of sugar in 100 cubic centimeters of the urine. The simplicity and rapidity (about two minutes being required for a titration), of this technique, combined with the accuracy of the test, and the stability and ease in making up the reagent, makes it compare favorably with all other quantitative methods known to us.

Before proceeding further, allow me to sum up the routine sugar tests to which each specimen is subjected when it arrives in the E. L. A. S. laboratory. First, it has to pass a qualitative test with Haines' solution. Then, if a reduction occurs, we make a phenylhydrazine test to identify the sugar which is causing the reduction, or perhaps find out that the reducing substance is not sugar; in the latter case no further investigation is made unless upon special request. Being convinced of the presence of sugar, our third step is to quantitate the amount of sugar with the ammoniated copper solution.

Having completed such a procedure we feel that we can confidently answer the question: Is there sugar in the urine, and, if so, how much?

Our records for the past six months show percentages in connection with our sugar findings which may be of interest to you. In interpreting this data, however, it must be borne in mind that specimens are only sent to the Home Office Laboratory when there is a history of albumin or of sugar, or of some other impairment in which a laboratory examination of the urine would be of value. Out of a total number of 14,922 specimens examined, 1,187 or 7.95% were found to contain sugar. On only 31 specimens, or .2% of the total number, did we have to report a reduction equivalent to 0.25% or more of glucose which was not due to glucose or pentose. The percentages of sugar found among the 1,187 may be of signi-

ficance: 92 or 8% of all sugars were found to contain, between 0.25 and 0.3%, which we report as "normal amount"; 242 or 20.8% contained 0.3 to 0.4% sugar; 164 or 14.2% contained 0.4 to 0.5%; 358 or 31%, 0.5 to 1%; 150 specimens or 13% contained from 1 to 2%; and the remaining 150 or 13% contained 2% or more of sugar. Consequently these figures show that 57% of all sugars found were more than a half of one per cent.

In conclusion I might add that out of a total of 9,165 death claims paid by the E. L. A. S. in 1919, 138 deaths or 1.51% were due to diabetes.

I find but one record available to tell what has become of applicants rejected on account of sugar, and what the mortality rate has been among those people. Dr. Barringer, formerly with the Equitable, reports the following in the *Journal of Medical Science*, June, 1907: "At the end of 5 years, 20% of a group of glycosurics had become diabetic, 15% had become suspicious cases; and 10% somewhat suspicious; 55% had remained free from diabetes."

The writer is greatly indebted to his Assistant, Dorothy J. Cooper, B.S., for her aid in preparing this article.

Dr. Pauli—We are very grateful to Dr. Exton and Mr. Wolf for contributing their experience in laboratory work to this Association. There are many valuable points presented in both papers.

The fund of information contained in Dr. Exton's paper may be discouraging to anyone who is not familiar with laboratory work, but intends to establish a Home Office laboratory. He may wonder whether laboratory work is not too complicated and if the Home Office laboratory is not too severe in their selection. Will a laboratory require such refinements as a blood analysis? I do not believe we can use methods in an insurance laboratory, such as essayist refers to, which are of great importance to a clinician who has hospital facilities for studying his cases.

Laboratory work is really very simple and the advantage of using uniform methods enables one to approve many risks,

which otherwise would be rejected. If the examiner reports doubtful albumin or sugar reaction and the Home Office examination of the same specimen is normal, the risk can safely be approved. You can depend upon work done at your Home Office laboratory. You have full jurisdiction over limits which you regard as normal and can raise or lower according to the mortality rate desired. It has been our experience to gradually lower the bars and not to make the examination too rigid. We are constantly accepting cases which would have been declined by our old rule, five or ten years ago. Our rules gradually were made more liberal. A Home Office laboratory is not a detriment to the agent or the applicant, but a distinct advantage.

Our laboratory examination requires only the essential tests for albumin, sugar, acetone, specific gravity, and microscopical examination for casts, blood cells, and pus. In my opinion, that is all that is necessary for practical purposes in an insurance laboratory. We do not use the test for chlorides, urea determination, Diazo reaction or bile pigment test. Nor do we try to differentiate epithelial cells.

We depend upon the specific gravity to determine the percentage of solids present. When the specific gravity is low (below 1014 with boric acid tablet), we require an equal number of specimens to have a normal specific gravity before the risk is approved. For large amounts we require a specific gravity of 1018. We pay no attention to urea and chlorides, as they fluctuate with the diet and are apt to lead to a false decision. The only importance of the presence of epithelial cells is that it indicates that the sample is a mixed specimen. What do I mean by a mixed specimen? I mean that the examiner has not permitted the urine to stand for several hours in a beaker and poured off the clear supernatant urine to send to the Home Office and left all the casts and epithelial cells in the bottom of the beaker. If you try to differentiate epithelial cells, you merely add complications which are of doubtful value, and there is danger of making a mountain out of a molehill. The Medical Director desires to know if the urinalysis indicates

any pathological condition which impairs the risk, and is not interested in temporary conditions.

The determination of sugar is well presented by both writers. It is a very simple matter to determine the presence of sugar; also the amount of sugar. But sugar in the urine is not always due to diabetes mellitus. The Medical Director must determine the importance of glycosuria. I was pleased to have our attention called to the nervous type of glycosuria. We have frequently noticed this type of glycosuria in our selection of risks. It is probably associated with hypersecretion of adrenal glands, and is very frequently accompanied by a high blood pressure. It occurs most frequently in people past thirty-five years of age. We have also noticed that the inspection reports often indicate that the applicant is of a high-strung nervous temperament.

The significance of glycosuria is best determined by a glucose test meal to establish the carbohydrate tolerance. If a sample voided three hours after the glucose test meal is normal, we approve the risk. The last 500 glucose tests showed 117 samples—23%—gave a positive glucose test (¼% or more or glucose); 383 samples were negative. We have used the glucose test for the past five years and our General Agents are furnished with a supply of bottles containing 100 grams of glucose, diluted with water so it will flow freely. When a sample of urine contains a small amount of sugar, or if acetone is present and no sugar is found in the urine, we notify the agent to have the examiner submit a glucose test. In this way, we eliminate diabetics who are on a restricted carbohydrate diet.

We accept as normal less than one fourth per cent. of sugar. One fourth per cent. or more, we decline the risk or require a glucose test for further consideration. The reactions for sugar commonly used depend upon the reduction of copper solution. It is immaterial which reagent is used—Fehling's, Haines' or Benedict's solution. Any laboratory worker becomes most proficient with the method and technique he is accustomed to using. He must be familiar with the variations in the reaction

to interpret the end results. It requires training and years of experience in daily use of the reaction to become expert in laboratory work.

Our routine method is to use Fehling's solution, 5 c.c. of the mixed Fehling solution is diluted with 5 c.c. of water and heated to boiling; then 5 c.c. of urine are added and boiled. If the specific gravity is below 1012, we use a double quantity of urine instead of diluting the Fehling solution with water. If any reaction occurs, we then use the fermentation test. Boric acid preservative does not interfere with the action of yeast, and we use a purer grade of yeast, which is prepared for bakers and sold in pound packages. It does not give the variations so often found in small cakes of yeast sold in grocery stores, which contain some carbohydrates, which yeast will ferment. It is essential to have a control tube with plain water. Do not permit the fermentation test to remain in the incubator more than twelve hours or fifteen hours. The fermentation tube is sealed by mercury to prevent the escape of gas. If the fermentation test is negative and filtered fermented urine reduces Fehling's solution, we then use orcin test to determine if pentose is present, and also apply phenylhydrazine hydrochloride test.

When the amount of urine received is limited, we use Benedict's test to determine if any reduction is present.

We were favorably impressed with the contact ring test for sugar, obtained with improved Haines' solution, as described in the *Journal of the American Medical Association*, January 31, 1920. The urine is stratified over Haines' solution, which has been heated, and a yellow ring forms at the contact of urine and copper solution in a few seconds. The phosphates form a white ring above the point of contact, but this does not interfere with the yellow ring when sugar is present in the urine. This reaction will detect .03% of sugar.

The various methods of making a quantitative determination of sugar, as described by Mr. Wolf, are very valuable. I remember that an article appeared in the London *Lancet* of March 6, 1909, entitled "Simple Method of Estimating

Amount of Sugar in Glycosuric Urine," by T. J. Walker. Walker used a graduated minim pipette and heated 30 minims of Fehling's solution and prepared a curve denoting the amount of sugar indicated by the number of minims of urine required to decolorize the Fehling solution. Walker's results were practically the same as those given by Mr. Wolf.

Whitney's Reagent—A solution of ammonia cupric sulphate was also used as a volumetric test solution for glucose. It is described in Greene's book (published by Blakiston in 1900)—*The Medical Examination for Life Insurance*, page 289. One dram of the reagent is heated to the boiling point. The urine is added minim by minim until the reagent is perfectly colorless, like water. The percentage of sugar is determined by referring to the following table:

If Reduced by Minims	It Contains to the Ounce Grains	Percentage
1	16. or more	3.33
2	8.	1.67
3	5.33	1.11
4	4.	0.83
5	3.20	0.67
6	2.67	0.56
7	2.29	0.48
8	2.	0.42
9	1.78	0.37
10	1.60	0.33

As we use the fermentation test for determining the percentage of sugar, we have not used these quantitative tests in our work.

It is very seldom that the reducing substance in the urine is not identified as glucose by fermentation test. We have, however, found a few cases of pentosuria.

Although pentosuria is a deviation from normal metabolism, it has no relation to diabetes mellitus. Carbohydrate food, such as bread, potatoes, rice, cane sugar, does not affect the pentosuria cases. There is a temporary form of pentosuria,

which results from eating fruits,—cherries, pears, plums, grapes, and blackberries, etc. We regard pentosuria as an anomaly of metabolism, which does not indicate an alteration of normal carbohydrate metabolism. We approved the risks for limited amounts, in order to obtain some experience with pentosuria cases. Up to the present time, no death claim has been presented on these risks.

Dr. Balch—We agree with Dr. Exton that "certain cases are obscured by incidentals"—and that "many are colored with doubt by chance specimens of urine which may happen to reflect a transitory, accidental, or insignificant condition." In our experience, specimens of urine of low specific gravity frequently show no albumin, sugar, or pus, when specimens of normal concentration, in the same case, may indicate a persistent, definite pathological condition. Dr. Exton has referred to this fact several times in his paper. Whether the dilution of the specimen is the result of ingestion of large amounts of fluid, or the inability of the kidney to excrete urine of normal concentration, must be determined by examination of further specimens collected after the risk has abstained from excess of fluids during several hours. Marshall and Kolls (J. Pharm. *Exp. Therap.*, Oct., 1920) have demonstrated experimentally the fact that "elimination of water, chlorides and urea is very markedly affected by changes in the blood flow through the kidney." It appears probable that some of the cases of abnormal concentration of urine may be the result of circulatory changes in the kidney.

The statement that "the tendency to rely on the intermittence of albuminuria as evidence of non-significance, is certainly not free from danger," is worthy of close attention. Among young people, perhaps below age 20, albuminurias are so common that their importance is comparatively slight. At the greater ages, the blood pressure is a most valuable aid in determining whether or not a true nephritic condition is present.

Our experience does not bear out the statement "less than an opaque or marked cloud (albumin test) is a safe indication

that the albumin and pus are not at all derived from the kidney, although microscopical pus run as high as thirty cells to the one sixth field." While it is probable that, when *both* these elements are derived from the kidney the amount of albumin will be greater, it is always possible that the pus may have its origin low down in the tract, while a small amount of albumin may be the result of interstitial type of nephritis. In doubtful cases we endeavor to determine the origin of the pus by using the two-bottle method of collecting specimens. If pus appears in the first portion voided and not in the second portion, it is safe to assume that the cells do not have their origin in the kidney.

We are certainly in need of new methods of estimating and reporting quantities of albumin. The present custom of reporting small, moderate, or large quantities of albumin allows such latitude that it is almost worthless.

Our experience has been like that of Dr. Exton,—"copper reducing urines are found more frequently than formerly," and this seems to be the general experience. It is quite likely that the increased use of sugar may account for many of these cases, but we are not prepared to admit that the chemical relationship between ethyl alcohol on one side, and aldehyd and keton derivatives of the polyhydric alcohols (carbohydrates) on the other side, has any bearing on the increased use of carbohydrates. The characteristic biological effects of ethyl alcohol are entirely absent in the other group named above. The point that we may expect an increase in diabetes is well taken. Allen's classical experiments show that a high sugar content in the blood acts as a direct poison to the cells of the pancreas which have to do with the assimilation of carbohydrates. It must be remembered, however, that sugar is a threshold substance; and that any considerable excess in the blood is rapidly excreted, provided that the renal function is normal.

We have been especially interested in the statement "our primary, practical problem then is to be sure, in a given case, we are dealing with glucose and not with some other reducing

substance in the urine, and it is well to realize that other reducing substances are frequently encountered, and that the copper tests are not specific for glucose." As a matter of fact, we have no test which is available for routine use in a busy laboratory, that is specific for glucose.

For practical purposes we have little choice between Benedict's and Fehling's solutions. Either test is sufficiently delicate to indicate traces of sugar which are of no importance, and negative reactions can be considered conclusive. Substances which affect our sugar reagents can be placed in three groups: (1) The sugars, including glucose, lactose, pentose, and maltose, and perhaps others. (2) Substances other than the sugars which give reactions, resembling those due to sugar, including uric acid. (3) Substances which inhibit the reactions of the sugar reagents, *i.e.*, make them less delicate. When small or atypical results are obtained in the sugar tests, it is our custom to clear the urine by the addition of a small quantity of lead acetate solution, and filtration. This removes a large portion of the substances of groups 2 and 3, and, after this procedure, the sugar reactions are much more clean cut and reliable. We have still to determine whether or not a reducing substance, present after clearing, is glucose; and the usual methods can be employed for that purpose with much greater accuracy than in the untreated specimen.

Our experience has been that the different osazones formed from glucose, maltose, lactose, and pentose cannot be differentiated microscopically when they are formed in the urine. Formed in clear water solution the crystals take on more or less characteristic forms, but in the urine other substances affect crystallization to such an extent that determination of identity by the crystalline form alone is very far from certain. We have also found the "Seliwanoff" test for fructose to be most unreliable in testing specimens of urine.

In the discussion of Dr. Exton's paper we have already taken up some of the points which occur in the one prepared by Mr. Wolf. In discussing Mr. Wolf's paper the most striking point

which appears is the tendency to disregard quantities of sugar below 25/100 of 1%. We note especially the statement "an investigation of 100 specimens which did not reduce Haines solution, showed a sugar content varying from 0.05 to 0.25%, which amounts are considered negligible by our Medical Director." It would be interesting to know what method was used in determining the quantity of sugar in these specimens. We find that 0.2% of glucose gives a very well-marked reaction for sugar with all the usual reagents, and it is our custom to report quantities below 0.2% as "large trace," "trace," and "slight trace." We look upon these minute quantities with some suspicion if they occur in specimens of low or normal concentration. If, however, they are found in specimens of high specific gravity, we are inclined to regard the concentration as being sufficient reason for their presence. It seems reasonable to assume that the normal sugar content of the urine is increased in concentrated specimens with the other solids present such as urea and chlorides. Quantities of 0.2% we regard with sufficient suspicion to require at least one specimen which gives no reaction for sugar, even though the specific gravity in the original specimen is high.

We have been unable to check up the reagent which is recommended as being negative to quantities of sugar below 0.25%. We would almost expect the limit to be a very variable one on account of the fact that other substances in the urine influence our sugar tests to such a marked extent. In any event, it would be our preference to use a reagent which would give more delicate reactions, and then to determine if the reactions were due to sugar, or to some other substance, and if due to sugar, whether or not this sugar is glucose.

Our experience has not been in accord with that of Mr. Wolf when he states that he has rarely found glucose to form phenylglucosazone unless glucose was present to the extent of 0.25%. We are constantly obtaining reactions with phenylhydrazine when the sugar content is far below 0.25%. We have been using a modified Pavy's solution which is much like the reagent which Mr. Wolf has used for titration, the principal difference

being that our reagent makes use of Rochelle salt, instead of glycerine. In both cases, one c.c. of reagent is equivalent to 0.1% of sugar. We find this reagent to work very well in many cases. In other cases, substances like uric acid give such a marked reduction that our results are entirely worthless. We have had specimens which titrate nearly 1%, but which gave only very small traces of sugar by phenylhydrazine and Fehling's solution, and the polariscope gave no reading at all.

We have counted the number of specimens received in the second section of the Metropolitan laboratories during one year, and the number showing positive sugar tests. The results are compared with those of Mr. Wolf in the following table:

Total specimens	Sugar tests positive	0.25% or less	0.25–0.5%	over 0.5%
Mr. Wolf 14,922	1187–7.95%	disregarded	43.2%	57 %
Metropol. 32,877	1734–5.2 %	70.9%	5.9%.	23.2%

From these figures it would appear that Mr. Wolf's results of estimation of sugar run much higher than do those of our laboratory, and this may account for the fact that quantities below 0.25% are disregarded by him.

Dr. Exton—I think it would be well for all of us to be perfectly clear on the question of what is a normal or physiological amount of sugar. In reviewing the literature of insurance medicine one gets the impression that ¼ or 3/10 of 1% is a perfectly normal amount of sugar to find in the urine. The bibliography of sugar nutrition and chemistry is exceedingly extensive, but I went to the trouble of having a very experienced librarian look through it from beginning to end, and the highest figures found in any authoritative work was 0.02%. Just as a sop I made it 0.03% in my paper. There is, of course, no objection to any company or any department, as a matter of policy, deciding for itself what amount of sugar in a given specimen they will take, but when it comes to talking about physiological or normal limits, a distinction between policy and facts should be kept in mind. It is true that higher figures for the normal urinary sugar have lately been given by Benedict and by Myers, but they have been tentatively obtained in

the course of work calculated to make the copper tests specific for glucose by first precipitating out all of the other reducing substances before estimating the glucose. Up to the present the results are questionable, and as they also give much higher figures for the delicacy of the copper tests we are in just about the same position as we were when it comes to interpreting our tests.

As to the copper tests, I agree with Dr. Balch that any of them will give satisfaction in the hands of one who understands and knows the tests he is using. Personally I do not take much stock in any of the methods in common use which give quantitative figures below 2/10 of 1%. If one uses the titration methods, and that is one of the objections to them, you encounter not only normal but abnormal reducing substances which always influence such determinations. We have not used them in our work, because we prefer what might be called the automatic tests by which one does something and sees the end result, instead of following a procedure all the way to a certain critical point which takes time and extra care. If one goes as far as to say that fermentation is needed in order to make polariscopy accurate, then it should be realized that fermentation is still more necessary if one uses the titration test for several reasons. By combining the polariscope with the apparatus which I have shown you the field of view is so much better than with the unaided polariscope that a very close result is possible.

I want to say to Dr. Pauli, that he did not see anything in my paper to the effect that I am at present advising blood analyses. That subject was brought into the paper because it is a laboratory article, and because I felt that no matter how the idea is at present regarded, you will get closer and closer to it in the years to come. Some day you will use the blood, at least for some cases, but it has been touched on merely in a suggestive way and without any design of recommending blood analyses at the present time.

Certainly the urea and the chlorides fluctuate with the diet, and I see no objection to any of the tables which I have seen

in former papers which have been presented here, tabulating that, with such and such a gravity one gets such and such an amount of urea. It may hold perfectly true for the normal cases, but I am dealing with the doubtful cases, and it will be easy for anyone to convince themselves that in this class of cases the ratios which have been given frequently do not hold true. In such instances a disproportion is often very suggestive, and that is the point I have wanted to bring out. Thus, often when you are dealing with a case of albuminuria you are in doubt as to whether it is worth while to send back and investigate that case further (I am talking about standard business). At times you will find a discrepancy more or less marked in what I have called the specific gravity, salt and urea ratio, and it will enable you to make up your mind that the case is not worth further consideration. Normal urine has a certain normal complexion or make up, even though it may happen to have albumin in it because of some temporary condition. Very often the fact that the specimens coming from a given individual are normal as to their make up, point to the temporary or insignificant nature of the albuminuria. On the other hand, when the metabolism is affected, not only by renal but by liver and other diseases, the urine does not always have a normal make up as it were, and when this is established it is also helpful in deciding the merits of the case. Let me emphasize that we do not quantitate ureas at all unless there is a particular reason for doing so. We do make the salt test because it means nothing more than dropping a drop of silver nitrate into the little sherry glasses that we use for making our Heller test, and it affords us at times a certain control.

I was very glad to hear Dr. Pauli tell how freely they give the glucose test meal. Whether the sugar in the urines of an individual is significant or not is after all determinable. If you are going to adopt a standard by saying we are taking this man because he has less than a certain amount of sugar, it is a hit or miss rule, and to be guided by that does not treat the case on its merits. If you want to you can find out the truth about the significance of the sugar in two ways. The best one

is to examine the blood, but for our purposes that is now out of the question. The next best way is to use the test meal. The digestive, nervous, or accidental glycosurias can only be ruled out by giving a test meal. The entire diabetic question becomes very simple if one first makes sure by proper tests that one is dealing with glucose and then determines the significance of the glucose of doubtful cases by a test meal.

Some one has just asked me about formalin as a preservative. Some have the idea that yeast will not work with formalin. It will, in such quantities as we use it. A long series of experiments in regard to this matter did not show any difference between urines preserved with formalin and those that were not so preserved.

With regard to fructose, lactose, and pentose, you have to go further than the fermentation test in order to make these distinctions. Idiopathic pentosuria—the kind spoken of in the text books—is a rare condition. Out of some hundred thousands of urines I have seen it only a few times. On the contrary, alimentary pentosuria, especially in the summer time, is much more frequent than is generally believed.

In regard to Dr. Balch's remarks about specific gravity and the custom of the Metropolitan in handling these specific gravity cases, our ideas run much along the lines of the Mosenthal test which is every day found increasingly useful in clinical work.

With regard to the matter of intermittence, and I mean intermittence in every sense, the specific gravity, salt and urea ratio will help out. Intermittence is not a safe guide as to the significance of albuminuria, but should be checked up by other criteria and the ratio I have offered has been found particularly helpful in just such cases.

As to my statement regarding the amount of cloudiness by the heat test showing whether the albumin is derived from the kidney or the lower tract, I can only tell you that in Dr. Cabot's service at the Post Graduate some ten or twelve years ago, we repeatedly made that observation and it has since been confirmed by Dr. Warren and others. If one gets a micro-

scopic picture of twenty or thirty pus cells to the one-sixth field and finds less than a marked cloudiness by the heat test, you may feel confident that you are not dealing with albumin derived from the kidney. Of course, you may have kidney disease without albuminuria, and you may have interstitial nephritis associated with pus coming from the lower tract, but the fine traces of albumin which show in such specimens do not denote a renal process.

I will not quarrel with Dr. Balch about what he says concerning the relationship between the alcohols and the sugars. I simply threw that in as it were because it interested me. Many people crave for sweets, and the close chemical relationship between the carbohydrates and the alcohols suggested the thought that some people were taking to sweets because they were not getting their alcohol. It is a pretty point and worth thought.

As to the significance of the phenyl-glaucosazone crystals met with in the urine, we have, since we have been using the apparatus that I have shown you, been able to identify perhaps fourteen different crystals which we are finding at times in the urine. Four or five of these we feel we are able to distinguish now any time when we meet them. With lactose and maltose, particularly, the differences from glucose appear much more marked than when seen by the unaided microscope. Further than that, in some instances we have taken cases because we have found two or three different kinds of crystals in the specimen. When these were found in small amounts we have been willing to believe, and I think rightly, that they were the product of a digestive upset of the whole carbohydrate outfit rather than a diabetic condition.

Mr. Wolf—Mr. President and Gentlemen: Dr. Weiss has called upon me to assist in the discussing of Dr. Exton's interesting paper. However, a reduced force, the vacation period along with an increased volume of work in the laboratory, have prevented me from devoting sufficient thought to this paper. The doctor has touched upon many phases of Clinical Pathology and has suggested procedures whereby the Medical

Director could possibly decide more confidently on the so-called "border-line cases." It is a question whether the results would be of enough value to warrant the expenditure of time and energy required to carry out such a program. Would not a physical examination rather than a laboratory test clarify many a doubtful case? Then, too, there is a wide diversity of opinion among Clinical Pathologists as to methods and findings.

Dr. Exton suggests the use of the specific-gravity-salt-urea ratio. May I inquire just how extensively he has used it and with what success. Personally I agree with Dr. Francis Carter Wood who states in his *Chemical and Microscopical Diagnosis*, 3d edition, page 472, that: "The practitioner would do well to spend his time examining urine for casts and albumin rather than in making quantitative determinations of urea. In the early cases where the diagnosis is important from the point of view of prognosis and treatment, urea may be excreted in perfectly normal manner. In the later cases the diagnosis of nephritis can be made more simply and surely by a physical examination of the patient and the study of the albumin reactions and a microscopical examination of the urinary sediment." On page 625, Doctor Wood also states: "The chloride secretion furnishes nothing of value in diagnosing the permeability of the kidneys except in advanced cases of nephritis. When œdema exists a considerable amount of sodium chloride is retained but this may be afterwards passed out if the chloride intake is reduced and the cardiac condition improves even if there is no change in the kidney."

In reference to the normal sugar content of urine are not Dr. Exton's figures (0.03 to 0.08%) rather low? Dr. V. C. Myers in the *Proceedings of the Society of Experimental Biology and Medicine*, vol. 13, No. 8, states: "Normal urine appears to contain between 0.08 and 0.2% of sugar."

Dr. Exton's reference to the presence of succrose in urine is of interest as Dr. Webster in his *Diagnostic Methods*, 5th edition, page 314, states: "Other carbohydrates such as dextrin, isomaltose, and saccharose, have been reported in the urine.

These are extremely rare and need little comment in this place. In the case of cane sugar the assimilation is so high that an alimentary saccharosuria could occur only after an enormous intake. Spontaneous excretion of cane sugar has never been actually proven, but this sugar may be found in the urine of hysterical patients who have added it to deceive the physician."

When levulose occurs, as it sometimes does, in conjunction with glucose in diabetic urine quantitations are satisfactorily made by the combination of titration and polarization.

Believing it would be a help to us in deciding "border-line cases," several years ago, we used the sugar tolerance test. However, the results were so confusing that it was discontinued.

For an approximate quantitation of albumin I would suggest the use of Tsuchiya's reagent, which is composed of 1.5 grams of phosphotungstic acid, 5 c.c. hydrochloric acid and alcohol sufficient to make 100 c.c. Procedure. In a 15 c.c. graduated sediment tube pour seven and one half c.c. of the filtered specimen, mix and centrifuge 4000 revolutions. Each c.c. of the precipitate is equivalent to 0.2% by weight of albumin in 100 c.c. of the urine.

We have not experienced the difficulty in taking the specific gravity readings of which Dr. Exton speaks. (We are using a small specially made urinometer graduated from 1.000 to 1.045 instead of 1.060 which insures a longer scale. This urinometer has a hand-made scale, and is fairly accurate and will take the gravity of a half ounce of urine. When we have smaller specimens to deal with we make use of glass beads.)

The differentiation of the different epithelial cells is somewhat unsatisfactory and depreciated by many authors. In my experience Dr. Ogden's description of the various cells has been of value.

Dr. Toulmin—It gives me a great deal of pleasure to move that the Association adopt the following resolution:

RESOLVED—That the members of the Associa-

tion of Life Insurance Medical Directors extend to the executive officers of the Mutual Life Insurance Company of New York a vote of thanks for the courteous and cordial hospitality shown them as guests of the Company.

Motion was seconded by Dr. Hobbs and carried.

Dr. Weisse—I am sorry that Dr. Knight, my successor, is not here for me to formally turn over the guidance of the Association to him for the coming year. I want to take this occasion to thank the members, who have in so many instances come from long distances to attend the meeting, and to thank each man who has contributed a paper, and each man who has taken part in the discussions, and also to thank our able Dinner Committee for their efforts last evening in making the meeting a success.

On motion, the meeting adjourned *sine die*.

The Annual Dinner of the Association was held on the evening of Thursday, October 21, 1920, at the University Club, New York City. The following members were present at the dinner:

T. D. Archibald, C. D. Alton, H. B. Anderson, A. W. Balch, W. B. Bartlett, J. T. J. Battle, W. W. Beckett, C. D. Bennett, A. W. Billing, D. N. Blakely, W. M. Bradshaw, C. T. Brown, L. D. Chapin, C. L. Christiernin, J. N. Coolidge, T. C. Craig, C. P. Clark, R. M. Daley, E. W. Dwight, O. M. Eakins, C. H. English, W. G. Exton, Z. Taylor Emery, J. W. Fisher, Paul FitzGerald, S. W. Gadd, Homer Gage, W. S. Gardner, A. H. Gordon, A. H. Griswold, F. L. Grosvenor, I. Haines, G. C. Hall, J. B. Hall, W. J. Ham-

mer, C. L. Harrison, A. B. Hobbs, Ross Huston, W. G. Hutchinson, C. B. Irwin, W. A. Jaquith, A. O. Jimenis, A. E. Johann, R. J. Kissock, A. S. Knight, W. W. Knight, J. M. Livingston, C. N. McCloud, T. F. McMahon, H. A. Martelle, C. F. Martin, O. F. Maxon, J. C. Medd, J. H. North, M. I. Olsen, T. C. Park, J. A. Patton, W. O. Pauli, J. S. Phelps, C. B. Piper, J. E. Pollard, A. T. Post, J. T. Priestley, F. P. Righter, T. H. Rockwell, O. H. Rogers, E. K. Root, R. L. Rowley, E. F. Russell, S. B. Scholz, Jr., Morton Snow, H. B. Speer, J. B. Steele, G. S. Strathy, Harry Toulmin, J. P. Turner, C. A. VanDervoort, J. H. Webb, W. H. Wehner, F. S. Weisse, F. C. Wells, F. L. Wells, C. D. Wheeler, C. F. S. Whitney, T. H. Willard, Gordon Wilson, McL. C. Wilson, Glenn Wood.

The absence of Dr. Wm. Evelyn Porter was noted with regret, and the following resolution was unanimously adopted:

That the members express to Dr. Porter their remembrance and sympathy in his illness, and regret that he could not be present with them, also the hope that his condition would soon improve and that he would once more be restored to his usual health and vigor, and that the Secretary be instructed to forward a copy of this resolution to Dr. Porter.

In the minutes of the Executive Council, adopted by the Association, it was recommended that the following papers be read by title and incorporated into the Proceedings of the Association:

THE X-RAY IN TUBERCULOSIS

By Lawrason Brown

Those whose faith in the X-ray was strong and compelling when in many it awoke only the antagonism of ignorance, long foresaw the many and varied uses of roentgenology. I well remember how some thirteen or fourteen years ago Dr. Cole's radiographs of a master-plumber finally decided Dr. Walter B. James to send him to the Trudeau Sanatorium, though he could detect no abnormal physical signs. While in the Sanatorium under my care he had a second hæmoptysis, and rales developed over the area indicated by Dr. Cole's X-ray plate. Four or five years later we installed at Trudeau an X-ray machine, and asked Dr. Cole to be our consulting roentgenologist. As I look back over this period I see how I wondered at first at what the X-ray revealed, then I grew somewhat skeptical at the more refined diagnoses, but finally, some years ago I became absolutely convinced that it was the greatest addition to sanatorium work that we have had in two decades, and the most stimulating factor in the production of more exact clinical work. To-day I never tell a patient he has not got tuberculosis until his X-ray plates are taken and reveal no positive changes. I think I can safely say that all of my colleagues in Saranac Lake feel the same way. We have come to depend upon the X-ray more and more.

As I understand it, the topic for consideration to-night is, is it worth while to study the thorax of applicants for life insurance roentgenologically? The problem is a difficult one for a medical man not versed in health insurance usages to approach. However, your work and outlook and mine do come more or less together when we consider prognosis, and indeed certain phases of infection.

Some fifteen or more years ago Mr. E. G. Pope and I began to study that all-absorbing topic of heredity. We had not gone far afield when the difficulties appeared to us to be so great that we decided to attempt to prove infection which seemed at

that time almost axiomatic [for we had not yet had to readjust our conceptions of much of Euclid by Einstein's disconcerting contributions]. We accepted infection in pulmonary tuberculosis and attempted to prove it. I pointed out the literature to Mr. Pope, and from that time on I was lost in the maze of higher mathematics he employed, until his death, and with which Karl Pearson pursued the subject to completion. If you accept hereditary taint, if you are willing to agree that assortative mating has some weight, then marital infection has some but slight importance. If you are not willing to accept these two somewhat uncertain provisions, then you undoubtedly have more evidence for infection of husband by wife or *vice versa*. This of course opens the question of contact infection in adult life, which I feel we must, in a certain proportion of cases of pulmonary tuberculosis, accept. It is but a step hence to the importance of family history. There are, of course, two sides to this: one affirms that not the germ but the tissue weakness or proclivity to tuberculosis is inherited; the other states it is all infection, mass infection if you will, and no hereditary factor enters in. In the first place, if we accept an hereditary factor, it does not imply, of course, that all the offspring possess it in equal degree.

Prognostic studies in pulmonary tuberculosis affect only those insurance companies which accept sub-standard risks. Mr. Pope and I again worked on this problem, and we found that the death rate for the apparently arrested cases was at first twice, later about three times, that of the general population (corrected rates), but this was reduced after eight to ten years. The quiescent cases have a death rate that rises in the third year to ten times that of the general population but later falls, and finally is only slightly above that of the rate of the apparently arrested. The active cases have a death rate forty times that of the general population at first but after eight to ten years approximates that of the quiescent cases.

Otto May in a recent article on "Tuberculosis and Life Assurance" (*B. J. Tub.*, 1920, 14, 1) states that the effect of a definite tuberculous family history shows itself in the younger

ages at entry, and in the early years of insurance. If the age at entry is 35 or over, the degree of tuberculous family history has no practical value for insurance work. The figures of the leading American insurance companies show that a positive family history of tuberculosis at the ages of 15 to 29 years varies in importance as the patient falls below his standard weight. If we accept May's conclusions that when a tuberculous family history is present, age at entry, and weight and build are very important factors, then we must also consider carefully occupation, habits, and past history of tuberculous disease.

This leads me to speak of two factors in the past history, factors which we have come to consider of paramount importance in the diagnosis of pulmonary tuberculosis, tuberculous pleurisy, and hæmoptysis. Your own figures, which I have taken from May's article, show that the ratio of actual to expected deaths with a history of one attack of pleurisy within two years was 147; two to five years previously, 146; five to ten years prior, 113; and more than ten years, 92. Only in the last group was the death rate from pulmonary tuberculosis about normal; in the other three groups it was three times to twice the normal rate from pulmonary tuberculosis.

Using figures from the same investigation in regard to applicants with a history of hæmoptysis, without a distinct history of pulmonary tuberculosis, the rate was 151% mortality when one hæmoptysis had occurred within five years of application, 131% when one hæmoptysis had occurred between five and ten years, and 102% when one hæmoptysis had occurred longer than ten years previously. The pulmonary tuberculosis rates were five times the normal in the first group, three times and twice the normal in the second and third groups. Dr. May thinks careful selection must have been shown in all other regards to have kept the rate down to 151% in the first group.

I have been unable to get the figures of your losses by pulmonary tuberculosis by age of the patient, and of the policy. You gentlemen are in the insurance business as a business primarily, though I am sure you are all anxious to further the

interests of medicine. I realize I am here to-night to present to you frankly whether or not I think it is wise for you to go into the X-ray field in regard to the selection of risks for life insurance. I shall endeavor to set before you what facts I know but you and your actuaries will have to apply them to the death rates of your risks.

It is unnecessary for me to point out that roentgen ray plates are shadowgraphs; that the flat plate is the summation of all the shadows that lie in each plane of the rays, and that stereoscopic plates resolve more or less these summations of shadows into their constituent shadows, and at times cause to disappear what might have been considered to be an increase over the normal shadows.

To establish a norm in roentgen ray work is most important. Many have become very expert in reading flat plates; and indeed all the original work was done with flat plates. However, in very early cases, slight shadows are often puzzling, and shadows lying under a rib are often difficult of interpretation. The stereoscope aids greatly in this, for the shifting of the tube separates some shadows from those of the ribs and clavicle, and a thickened root shadow may resolve into normal constituents. I have mentioned these facts because there has been much difference of opinion. Some have held that only stereoscopic plates should be made, together with a flat plate taken in the opposite direction. Another group has affirmed that a single plate is sufficient. Dr. Cole, whose untiring efforts in the interest of such work cannot be too highly praised, took roentgenograms of 100 men to determine if one flat plate would reveal lesions sufficiently gross to arouse the question of possible rejection for the army. Posterior-anterior stereoscopic and flat anterior-posterior plates were taken, and it was decided that the single plate was sufficient for work in which only gross lesions need to be detected. It should, however, be borne clearly in mind that many are just as sure that in the study of a patient stereoscopic plates are always to be desired, for the reasons previously mentioned. It will be fortunate if they are not necessary here, for they require five times as long

to take, develop, and read as a single flat plate. The same objection applies more fully to the use of the fluoroscope which, in view of its uncertainties of interpretation and other objections, seem to be unsuitable for this work.

X-ray examination proceeds usually in an orderly fashion after: first, the occurrence of symptoms and, second, the seeking of medical advice. Along this well-beaten track many have passed and our data are backed by years of experience. Few have studied the X-ray findings in groups of apparently healthy men, men for example that you seek to insure. Hamman and Baetjer examined fifty apparently healthy physicians and medical students by the usual physical and X-ray methods. On physical examination 11 were normal, 18 had right apical signs, 12 left apical signs, and 9 had both apices involved. A large number had slight dulness, some variation from normal in breath sounds and fine rales, but only 2 had the rales usually found in pulmonary tuberculosis, call them moderately coarse, latent, indeterminate or what not. The plates taken were flat plates, and the results published, taken in the light of our knowledge to-day, would suggest strongly that no more than two of the 46 persons examined roentgenologically had definite roentgenological evidence of pulmonary tuberculosis.[1] Dr. Baetjer was good enough to let Mr. Sampson and myself go over some of these plates and his readings closely coincide with those made by Dr. Cole under similar circumstances.

It seemed to many of us that the examination of the soldiers would afford us a wonderful opportunity to get, so to speak, an X-ray cross section of the male population between twenty and thirty years of age. We felt that if we could get X-ray plates of some 10,000 men who had been already passed by the draft boards, and the palpably unhealthy eliminated, we could be in a position at this present moment to speak authoritatively upon a matter of great importance to every one in America. Our idea was not that those men who showed defi-

[1] Hamman, Louis, and Baetjer, F. H., "Pulmonary Physical Signs and Roentgen-Ray Findings in Healthy Adults," *Arch. Int. Med.*, November, 1914, p. 757.

nite X-ray lesions of pulmonary tuberculosis should be eliminated but that all except those disqualified by other methods than the X-ray be allowed to go to the front. By this procedure we argued that we could gain information about the prognosis in such cases as revealed a lesion in the lung, definite by X-ray examination, indefinite or lacking by ordinary physical examination. Those in charge at the Surgeon General's office in Washington, decided, however, that the time for experimenting was not then and refused to act on our suggestion. It seems to us somewhat ironical that a few months later they appropriated $10,000, the sum that we asked for, to produce a moving picture showing how to examine a chest.

We were fortunate, through the kind offices of General Stotesbury, General Berry, Dr. Biggs, and a few others, to have an opportunity to examine the data from two groups of National Guardsmen. The first study of 100 men was made on some members of the Twelfth Regiment of the New York National Guard, which had seen service on the Mexican border and had been subjected to several examinations by army medical men. Some of them, however, had been recruited since the regiment returned from the border. While the physical examination of the lungs may not have been as searching as if performed by lung specialists, nevertheless the strict requirements, such as those of weight, must have ruled out many doubtful recruits. It was, however, decided to subject these 100 men to a careful, independent, comparative study of the roentgen ray and pulmonary physical findings. Dr. James Alexander Miller, with a staff of able assistants, made the examinations. In all, roentgenograms of 100 men were taken, and in ninety-two cases the plates were satisfactory for study. Six men were roentgenographically positive for tuberculosis, one possibly had sarcoma, and one possibly Hodgkin's disease. In one the presence of a cavity was entirely overlooked by the physical examiners, and three men showed physical signs without roentgenographic findings. The physical examination and the roentgenogram agreed in five cases, and all eight were rejected. Dr. Baetjer (and a number of others,

among them J. A. Miller, E. R. Baldwin, and H. W. Biggs) agreed with Dr. Cole's interpretation of those plates that showed tuberculous changes.

It is an easy matter for you to figure out what number of your new policyholders would be disqualified each year if 3% of the acceptances were found to be diseased. A little additional calculation would indicate to you your loss if these persons rather speedily succumbed.

These facts were presented to Ex-Governor Whitman, and he set aside $1500 for a study of a thousand men in the 69th Regiment of the New York National Guard. Dr. Cole was again in charge of this study, and was assisted by Dr. LeWald and a number of other experienced men. It was hoped by this experiment to demonstrate the possibility of taking plates of every soldier in the national Army, and to do so as rapidly as the physical examination of the lungs could be made.

The study showed that with two staffs or groups of roentgen-ray men a thousand plates could be taken, developed and read in a day. The work would be rough but many lesions would no doubt be revealed that would otherwise escape detection, and I refer not only to pulmonary lesions, but to osseous, vascular, and cardiac lesions as well. The mechanical detail of this work will no doubt be reported by Dr. Cole at some later time. In the plates of 1030 men of this regiment, about 1000 were useful for study. Of these, thirty-four were found to have such definite parenchymatous shadows that Dr. Cole and Dr. Allison advised rejection. The plates of thirty-two others strongly suggested definite tuberculous lesions. Baldwin, Heise, Sampson, and I went over these plates very carefully, and on account of changes which we interpreted as old lesions, would reduce Cole's figures of thirty-four to twenty-eight, and add the six to the doubtful cases, making thirty-eight. These six cases and some of the other doubtful plates, had they been found in patients with symptoms, could have been interpreted no doubt, as showing definite tuberculous changes. Dr. H. M. Biggs and Dr. Lewis Connor agreed in the main with these interpretations.

The physical examination of these men was undertaken by a group of good clinicians under Dr. Connor of Cornell. The result of their examinations was most interesting. Of the entire regiment (about 2200 men), they certified six for rejection on account of pulmonary tuberculosis. Of these six, four showed lesions in the roentgen ray plate and were rejected, while the other two had negative plates, and were accepted. Of the four rejected, only one fell in the group of the thousand already examined by roentgen ray, thirty-four (accepting Cole's readings) were positively tuberculous and should have been rejected, but on physical examination only one was discovered. At Dr. Biggs' suggestion Dr. Connor and his assistants reëxamined twenty-six of these thirty-three men. The others were away or in the hospital and could not be reexamined. The men were of course all made to cough, and each was examined by three physicians. Abnormal physical signs were discovered in one or more men and they were rejected. Three others were rejected also on the history of previous symptoms.

This great discrepancy between roentgenograms and physical signs emphasizes the fact either that in apparently healthy men shadows on roentgenographic plates do not bear the same significance that they do in patients with symptoms, or that in many apparently healthy men roentgenographic study will reveal tuberculous pulmonic changes before symptoms of such intensity as to attract attention arise, and long before physical signs indicative of pulmonary disease are to be discovered. The latter assumption may explain those sad cases in which the patients suddenly develop extensive physical signs and pass, so to speak, at a bound from a stage of doubt to a stage of well-developed disease.

Further X-ray studies have been made by Matson,[1] and Diemer and McRae.[2] Their figures overlap and I shall discuss only Matson's which include those of Diemer and McRae. His figures include 72,985 draft men examined by clinical methods. Of these 16,589 were examined fluoroscopically.

[1] R. C. Matson, *J. A. M. A.*, 1919; 72, 1887. [2] *Ibid.*, 1919, 72, 172.

Of these 1843 were pronounced tuberculous or "suspicious" by the roentgenologists, and 2367 were diagnosed as tuberculous on the preliminary examination. On further study 884 were found tuberculous and 570 were discharged as active cases. Without going farther into details Matson concludes that as far as military service is concerned, fluoroscopic examination occupies a place of secondary importance when compared with careful expert physical examination.

In Baetjer's 46 cases you will recall that only 2 had a definite parenchymatous lesion, while in Cole's thousand there were 34 (or 28), and in his 100 cases there were 8 rejections. Attention may be drawn to the fact that 3% more cases were rejected by X-ray findings in Cole's 100 cases, and 0.2% in his 1000 cases. Do not forget, however, that experts made these physical examinations, and some men were reëxamined, after the positive X-ray evidence was at hand. This possibly accounts for the figure as small as 0.2%. Now it is a matter for the actuary to determine whether it costs less to take single plates of your new risks or to pay death premiums in such a time that the company loses money.

Mr. Sampson and I a few days ago went over 807 cases at Trudeau. We divided them into those with and those without rales of any description and any location. While many of the patients (561) with rales were not definitely tuberculous, I want to discuss only the 246 patients without rales. We next divided these into 143 cases without any parenchymatous lesion, and 104 cases with a definite parenchymatous lesion in the lungs. We then studied the occurrence of tubercle bacilli, hæmoptysis in these cases and found that with a definite X-ray lesion, 20% had tubercle bacilli, 21% had hæmoptysis, 20% had tubercle bacilli and hæmoptysis, and 39% had neither. On the other hand, when there was no definite X-ray lesion 10% had tubercle bacilli, 24% had hæmoptysis, 2% had both, and 64% neither. In each group 9 had had tubercle bacilli prior to admission, and it is interesting to note that none with an indefinite X-ray were confirmed later, while in those with a definite X-ray, 8 were confirmed

later. These patients were of course referred to us because someone suspected the presence of pulmonary tuberculosis.

These are the facts that I have been able to gather and in a few words I will try to show you what they mean to me.

To-day it seems to me that if you accept the view that infection takes place only in childhood marital exposure should count for little, and you could dismiss it in your selection of risks. If, however, you believe as I do, that it can, and frequently does, occur then I believe that you should take every measure to exclude pulmonary tuberculosis in risks who have been intimately exposed. Physical examination, no matter how expert, does not accomplish this. X-ray studies must be made. Tuberculous pleurisy is caused by tubercle bacilli that pass through the lung and irritate a pleura already sensitized to them. It is inconceivable that some do not remain enmeshed or fixed in some of the many deposits of lymphoid tissue scattered throughout the lung. Here they may remain dormant until another infection from without or from within produces a condition suitable for their increase. As I conceive the problem, pulmonary tuberculosis, for example, is the result of many infections, superimposed reinfection at short intervals in the negative stage if you wish so to express it. With each untimely reinfection the tuberculous process in the lung advances slightly. Without further details it seems to me a wise plan to subject all of your risks who have had pleurisy with effusion to roentgenological examination. Hæmoptysis would demand similar care, and possibly risks with substandard weights. All risks who desire large policies should always, it seems to me, from the figures I have given you, be studied by the X-rays. Finally, though I have no figures to back me up, I am confident that many risks which you postpone or even reject on account of possible pulmonary or thoracic disease, might be accepted after a careful roentgenological examination.

1. Many individuals harbor the tubercle bacillus throughout life. Commensalism, not parasitism is present.

2. In some instances definite pulmonary tuberculosis may

be present without physical signs, and without any very definite or diagnostic symptoms.

3. Slight symptoms of ill health may occur without the presence of abnormal physical signs, and the X-ray reveal definite and fairly extensive pulmonary tuberculosis.

4. Physical signs may be the first definite proof of pulmonary tuberculosis and yet occur only after extensive involvement of the lungs has taken place.

5. Slight attacks of pulmonary tuberculosis may occur and escape the attention of the patient who calls them colds.

6. Compensatory emphysema in and about the focus, and slight displacement of the mediastinum and diaphragm may mask such a process in a well-developed and symmetrical chest.

7. Insurance applicants may easily conceal symptoms of ill health, especially if known only to themselves.

8. An X-ray examination may reveal or verify cardiac, arterial, and osseous changes hitherto unsuspected.

9. The fluoroscope is of far less value in this work than a single flat plate, and the stereoscopic plate is far superior to the flat plate.

10. Risks with poorly developed chests, long, narrow, rounded thoraces, should always be X-rayed for infection, and indeed definite disease may be concealed in the depth of such a thorax.

11. Heredity that does not include definite exposure, particularly in childhood, need not be considered if the roentgen plate and examination is negative.

12. Former exposure in marital life, after diagnosis and training of the patient, can be disregarded if both plate and physical examination are negative and the couple live hygienically.

13. Applicants with a history of definite pleurisy should always be X-rayed, and definite parenchymatous disease excluded before acceptance.

14. A history of hæmoptysis at any time demands substandard risks or a negative X-ray plate and physical examination, and a period of normal health.

15. From 0.2% to 3% of apparently healthy individuals between 20 and 30 years of age, apparently without symptoms, may be found to have concealed pulmonary tuberculosis.

THE ROENTGENOLOGICAL DETECTION OF LATENT OR NON-CLINICAL PULMONARY TUBERCULOUS LESIONS

By Lewis Gregory Cole

Professor of Roentgenology at Cornell University

We have gathered here to-night in this informal manner to consider and discuss with each other the value, limitation, and practicability of the use of the X-rays in life insurance examinations, particularly examinations of the lungs and heart. So far as my part of the program is concerned I shall not describe anything that is new or advanced, but will be content with discussing, and demonstrating on slides, facts which have stood the test of time.

From 1906 to 1909 I worked enthusiastically on the X-ray diagnosis of pulmonary tuberculosis and, in 1910, published the results of that work. What I have to say to-night is based largely on that work, after ten or twelve years of practical experience. At that time I mentioned that the roentgen diagnosis of pulmonary tuberculosis should be based on the visualization and interpretation of isolated or conglomerate tubercles in the parenchyma of the lung or fibrous tissue characteristically distributed through the lung or about the hylus. In describing the roentgenological findings of pulmonary tuberculosis we will, to a certain extent, use quotations from the original article. In order to devote more time to the roentgenological aspect of these, very little if any reference will be made to symptomatology, objective symptoms, hæmoptysis, sputum examinations, etc. Reference from time to time will be made to physical signs. This, I stated in the original article,

has always been the sheet anchor for clinicians in the diagnosis of pulmonary tuberculosis, and, as it is a tool belonging to every physician, it should be used to the maximum of its efficiency.

Physical signs may be divided into two distinct classes:

1. Those which are directly the result of tuberculous infiltration,—such as dullness, altered fremitus, changes in the voice sounds,—and these are the real physical signs of tuberculous consolidation and infiltration and naturally do not occur until the process has passed beyond the stage of pathological incipiency.

2. Physical signs, on which the diagnosis of incipient tuberculosis is based,—such as sub-crepitant rales or clicks—are not the signs of consolidation or infiltration but the signs of moisture in the bronchi, which may or may not be of tuberculous origin.

That there may be no misunderstanding of the term "miliary tubercles" I quote the definition of miliary tubercles from Delafield and Prudden.[1] "Miliary tubercles are small nodules of irregularly spheroidal shape,—the smallest hardly visible to the naked eye, the largest as large as a pea. The term miliary tubercle, which arose from the crude coincidence in size between small foci of tuberculous inflammation and some forms of millet seeds, is now liberally applied to tubercles which are much larger as well as those which are much smaller than the millet seed." In speaking of miliary tubercles I refer to those of moderate size which on cross section of the lungs appear as grayish-white nodules about the size of the head of a pin. Pathologically, these are composed of cellular elements or productive tissue in a number of adjoining air cells. In studying them roentgenographically they are compared, in density, with the surrounding air-filled cells instead of with tissue of similar density, as is the case in tuberculous infection in other parts of the body. This is the reason why isolated miliary tubercles show in the lung and not in any other tissue of the body. It is universally admitted that the larger necrotic and

[1] *Pathology*, p. 216.

calcareous tubercles show. I do not claim to show the microscopic ones; but it is the intermediate tubercles—the smallest ones that are clearly discernible by the naked eye on section. Those that give the shotty feeling to the section of the lung—are the ones that show in roentgenograms having sufficient detail. It is on these tubercles that the positive diagnosis of pulmonary tuberculosis by the roentgen method depends.

Prior to the interpretation of these roentgenological findings, pathological specimens of lungs were selected that had been removed from the thorax without tearing the pleura. They were inflated to about the extent of a normal inspiration, and roentgenograms were made. These specimens were then sectioned and compared with the roentgenograms, and the lesions were readily identified and confirmed microscopically.

In addition to the simple detection of the pulmonary lesions in the original article, I gave a classification of the types of lesions that we felt that we could interpret, and also a classification according to the anatomical distribution of these lesions. This was subsequently simplified, and the latter was based on a simplified anatomical pathological classification which was approved by Dr. James Ewing. Not only the location and extent of the lesion should be determined, but the lesions may be definitely arranged in groups which correspond readily with the pathological classification of tuberculosis, which will be shown later.

It is contended by many observers that over 90% of all adults have, at some time, had tuberculosis and that there is evidence at autopsy of anatomic tubercle in approximately 90 to 93% of the autopsies.

Provided we consider calcified lymph glands as evidence of a preëxisting tuberculosis, the all-important fact with pulmonary tubercle lesions is to determine whether the lesion is of clinical or non-clinical importance.

In order to reach the group of non-clinical cases covered in this paper, we feel that it is more or less necessary that we should, at least in a superficial way, describe the clinical group of cases which may possibly be defined as active or progressive

tubercle lesions. The clinical cases present a picture which is readily recognized by the clinical history and physical examination, in a great majority of cases, if the patient is observed by a competent diagnostician during the stage of activity. There are a few exceptions to this where the tuberculous process is centrally located, or where it is in the upper lobe and well out under the shoulder girdle, more behind than in front, or in a few instances where there is an early process in both lungs of about equal extent. In this paper practically no consideration will be given to this type of process, because it is not this class of cases which are of greatest interest to those assembled. If this process is arrested at a relatively early stage, before caseation and necrosis is established, this type of lesion undergoes chronic changes and becomes latent, and, with a subsidence of symptoms, a non-clinical type is established, and these then form part of the second group,—namely, non-clinical or latent tuberculous lesions, which is the group of cases which most interests us from an insurance standpoint.

In the group of clinical lesions, there is especially one type of case which has always impressed me as being of extreme importance from a life insurance standpoint,—that is, that group of cases which shows definite, solitary, anatomic tubercles distributed principally at the apex which show neither clinical symptoms or physical signs. This type of lesion contributes a strong argument in favor of the fact that tubercle changes in the lungs can be detected roentgenographically before they produce either clinical symptoms or physical signs, and this group of cases is usually of the clinical type, inasmuch as the majority of them show a progressive type of pathology.

Now that we have stated that there can be definite evidence of tubercle pathology in the lungs which goes through the cellular stage, and eventually become fibrous or calcific, without presenting a classical or typical clinical picture, we feel that we may proceed with that important group of arrested cases which at some time must have passed through the clinical stage, frequently without being clinically recognized.

This group is composed of those cases that, with or without recognized clinical history, have, during adolescence or early life, developed a tuberculous process involving the hylus, bronchi, or the parenchyma of the lung. The immense number of autopsies in which such a process is observed, where tuberculous infection has not been suspected and the patients have died of intercurrent disease, indicates that these form an extensive group. Unquestionably, in some of these cases at the time of the activity of the lesion, a very careful physical examination by an expert diagnostician—such as a life insurance examiner—might have elicited physical signs that would have justified one in making a positive diagnosis of the lesion, but unfortunately, in many instances, the symptoms are not sufficiently severe to warrant the patient in seeking medical advice, or the general practitioner, in making a superficial examination of these cases, has overlooked its presence. After the clinical symptoms have subsided and the physical signs of accompanying bronchitis have disappeared, if the infiltration in the lung, with the cellular exudate and fibrous deposit, has not been sufficient to cause physical signs, the process, especially if centrally located or well out under the shoulder girdle, can escape detection even by the most careful physical examination. If, after the escape of physical detection, the patient is restored to apparently perfect health and is an applicant for life insurance, and if he is fortunate enough to have had a doctor who did not recognize the symptoms and signs as suggestive of tuberculosis, such a person would be an easy mark for the life insurance agent and a most difficult mark for the medical examiner. Roentgenographically, this type of lesion would be readily detected.

I would like to close with the following résumé. The brief, concise statements that follow are not predictions. They are facts that have stood the test of time for a decade.

1. The presence or absence of a tuberculous process in the lungs can be determined by the X-rays with a greater degree of accuracy than by any or all other methods combined.

2. The location and extent of a tuberculous process of the

lungs can be determined by the X-rays with a greater degree of accuracy than by any or all other methods of examination while the patient is living.

3. The type of pathological process, according to the classification of Delafield and Prudden,—that is, whether it is acute miliary, sub-acute miliary, chronic miliary, acute pneumonic, or chronic fibroid tuberculosis may be determined by the X-rays with a remarkable degree of accuracy.

4. If the statement that 90% of adults have had tuberculosis is true, and if one admits the pathological contention that calcifications in the lymphatic glands is the result of tuberculous infection, the X-rays corroborate the statement that 90% of individuals have had a tuberculous infection.

5. By the use of X-rays one can even differentiate those cases that are of clinical significance from those that are definitely not of clinical significance.

6. From a single X-ray examination one cannot determine the day, the week, or even the month that a given process was active, but by a series of X-ray examinations made at sufficient intervals, one can compare the minute details of one set of plates with previous plates and determine with great accuracy whether or not the process is undergoing progressive, stationery, or retrogressive changes.

The negative diagnosis of pulmonary tuberculosis from X-ray examinations is of as great importance as the positive diagnosis. The overzealousness of examiners has led many men to err in favor of a positive diagnosis with the result that many individuals are refused for life insurance on an unsubstantiated diagnosis. The definite negative diagnosis on a pair of good stereoscopic plates should and will, in the future, remove the stigma of such erroneous diagnosis.

In conclusion, may I state a hypothetical situation,—if the insurance examiner could remove the lungs from each applicant and section them in sections one-quarter of an inch thick and lay them out on a table and minutely examine each section, run his finger over the cut surfaces for the shotty feeling of tubercles, and then reassemble the sections and put them back

in the thorax without pain or detriment to the applicant, would such a procedure materially aid him in determining whether or not the applicant was a good risk? If the examiner's answer to this hypothetical question is yes, I would say that with a satisfactory set of stereoscopic plates of the lung one might determine the presence or absence of a tuberculous process, its location and extent, whether it is active or inactive, with a greater degree of accuracy than he could by such an impossible procedure as we have just stated.

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Illinois Life, Chicago, Ill.	Glenn Wood, M.D.
Imperial Life, Toronto, Ont., Can.	H. B. Anderson, M.D.
Jefferson Standard Life, Greensboro, N. C.	J. T. J. Battle, M.D. J. P. Turner, M.D.
John Hancock Mutual Life, Boston, Mass.	E. H. Allen, M.D. W. B. Bartlett, M.D. I. Haines, M.D. Edward B. Kellogg, M.D.
Life of Virginia, Richmond, Va.	George C. Hall, M.D.
Lincoln National Life, Fort Wayne, Ind.	C. H. English, M.D.
London & Lancashire Life, Montreal, Que., Can.	A. H. Gordon, M.D.
London Life, London, Ont., Can.	Angus Graham, M.D.
Manhattan Life, New York, N. Y.	Thomas C. Craig, M.D. Z. Taylor Emery, M.D.
Manufacturers' Life, Toronto, Ont., Can.	T. F. McMahon, M.D.
Maryland Life, Baltimore, Md.	Gordon Wilson, M.D.

Massachusetts Mutual Life, Springfield, Mass.	Laurence D. Chapin, M.D. Ralph B. Ober, M.D. S. B. Scholz, Jr., M.D. Morton Snow, M.D. George S. Stebbins, M.D.
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Missouri State Life, St. Louis, Mo.	
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Mutual Life of New York, New York, N. Y.	W. M. Bradshaw, M.D. Francis D. Merchant, M.D. Wm. Evelyn Porter, M.D. Eugene F. Russell, M.D. Henry H. Schroeder, M.D. Brandreth Symonds, M.D. Faneuil S. Weisse, M.D.
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New England Mutual Life, Boston, Mass.	David N. Blakely, M.D. E. W. Dwight, M.D. Wm. B. Robbins, M.D.
New York Life, New York, N. Y.	Thomas W. Bickerton, M.D. Robert A. Fraser, M.D. Calvin L. Harrison, M.D. Angier B. Hobbs, M.D. Morris L. King, M.D. Ernest H. Lines, M.D. James H. North, M.D. Oscar H. Rogers, M.D. Paul E. Tiemann, M.D. Harry P. Woley, M.D.
North American Life, Chicago, Ill.	C. B. Irwin, M.D.
North American Life, Toronto, Ont., Can.	T. D. Archibald, M.D.

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Pacific Mutual Life, Los Angeles, Calif.	W. W. Beckett, M.D.
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Royal Union Mutual Life, Des Moines, Iowa	James T. Priestley, M.D.

Security Mutual Life, Binghamton, N. Y.	R. L. Lounsberry, M.D.
Standard Life, Montreal, Que., Can.	Charles F. Martin, M.D.
State Life, Indianapolis, Ind.	J. L. Larway, M.D. C. B. McCulloch, M.D.
State Mutual Life, Worcester, Mass.	Homer Gage, M.D. Charles D. Wheeler, M.D.
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Travelers, Hartford, Conn.	W. W. Dinsmore, M.D. F. L. Grosvenor, M.D. McLeod C. Wilson, M.D.
Union Central Life, Cincinnati, Ohio	William Muhlberg, M.D. W. O. Pauli, M.D.
Union Mutual Life, Portland, Me.	Edwin M. Northcott, M.D.
United States Life, New York, N. Y.	John P. Munn, M.D. H. A. Pardee, M.D.

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Bankers Life Company, Des Moines, Ia.
Mutual Trust Life Insurance Company, Chicago, Ill.
Philadelphia Life Insurance Company, Philadelphia, Pa.
Volunteer State Life Insurance Company, Chattanooga, Tenn.

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William R. Bross, M.D.	New York, N. Y.
Robert L. Burrage, M.D.	Newark, N. J.
James Campbell, M.D.	Hartford, Conn.
Frederick W. Chapin, M.D.	Springfield, Mass.
Ferdinand E. Chatard, M.D.	Baltimore, Md.
Edward Curtis, M.D.	New York, N. Y.
Clark W. Davis, M.D.	Cincinnati, Ohio
William B. Davis, M.D.	Cincinnati, Ohio
Charles A. Devendorf, M.D.	Detroit, Mich.
Frank Donaldson, M.D.	Baltimore, Md.
Thomas A. Foster, M.D.	Portland, Me.
Thomas H. Gage, M.D.	Worcester, Mass.
Walter R. Gillette, M.D.	New York, N. Y.
Frank S. Grant, M.D.	New York, N. Y.
Landon Carter Gray, M.D.	New York, N. Y.
Edward H. Hamill, M.D.	Newark, N. J.
Edgar Holden, M.D.	Newark, N. J.
John Homans, M.D.	Boston, Mass.
John Homans, 2d, M.D.	Boston, Mass.
Abel Huntington, M.D.	New York, N. Y.
John M. Keating, M.D.	Philadelphia, Pa.
Edward Lambert, M.D.	New York, N. Y.
John B. Lewis, M.D.	Hartford, Conn.
Henry P. Lyster, M.D.	Detroit, Mich.
Elias J. Marsh, M.D.	Paterson, N. J.
Lewis McKnight, M.D.	Milwaukee, Wis.
Allison Maxwell, M.D.	Indianapolis, Ind.
William Natress, M.D.	Toronto, Ontario
Frank K. Paddock, M.D.	Pittsfield, Mass.
Oliver P. Rex, M.D.	Philadelphia, Pa.

James F. W. Ross, M.D.	Toronto, Ontario
Gurdon W. Russell, M.D.	Hartford, Conn.
George R. Shepherd, M.D.	Hartford, Conn.
Melancthon Storrs, M.D.	Hartford, Conn.
H. Cabell Tabb, M.D.	Richmond, Va.
James Thorburn, M.D.	Toronto, Ontario
James D. Thorburn, M.D.	Toronto, Ontario
Henry Tuck, M.D.	New York, N. Y.
S. Oakley Van der Poel, M.D.	New York, N. Y.
A. L. Vanderwater, M.D.	New York, N. Y.
Clinton D. W. Van Dyck, M.D.	New York, N. Y.
A. C. Ward, M.D.	Newark, N. J.
Frank Wells, M.D.	Boston, Mass.
George W. Wells, M.D.	New York, N. Y.
A. H. Whitridge, M.D.	Baltimore, Md.
George Wilkins, M.D.	Montreal, Can.
G. S. Winston, M.D.	New York, N. Y.
Albert Wood, M.D.	Worcester, Mass.
Joseph C. Young, M.D.	Newark, N. J.

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